THE

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ELECTRICAL REVIEW.

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MUNICIPAL SALARIES.

TRADE activity invariably brings in its train discontent in labour circles. No sooner does a manufacturing concern show a large credit balance than its employés are up in arms for better pecuniary recognition of their individual services. In illustration of this, take the recent strikes of coal miners, railwaymen, dockers, carters, restaurant waiters, and the less important strikes of electric wiremen in Bradford, Glasgow, &c. With the price of raw materials increased by 20 to 30 per cent., and manufacturers' costs proportionately augmented, freights have become high, giving a corresponding rise to the price of foodstuffs. Rents and taxes, also, have gone up considerably all over the country. It is, therefore, not surprising that skilled artisans, and, for that matter, foremen and superintendents, should expect their wages to be increased in such proportion as will allow them to live at least as comfortably as they have hitherto been able to do.

In another column of this issue we print an article dealing with the standard of salaries and wages paid to officials in municipal undertakings in this country, illustrated with curves indicating how their emoluments vary with the responsibilities appertaining to their positions. From a consideration of the data given in the article, it would appear that the average municipal electrical engineer's responsibilities are not adequately recognised. Too often is a cheese-paring policy adopted by Electricity Committees in fixing the salaries of the electrical staff, on the ground that they are thereby tending to reduce the assessments levied on the ratepayers of the Borough. In many municipalities, the Committee appoints an engineer to control the whole undertaking, with full powers to deal with all the members of the staff; in others, all the primary assistants hold their appointments directly from the Committee. With the former arrangement, each employé's hopes for future advancement in this world are centred in one individual—his chief. Under the latter arrangement a competent assistant, who has inadvertently given his chief cause for annoyance, may have some consolation in knowing that, although he must submit to the ruling of his chief in matters affecting his work, he is not entirely at the mercy of his superior in office. Much can be said for both methods of management.

The Stoke-on-Trent Council evidently holds the belief that it, as a body, is best able to decide what increase of wages, if any, should be granted the employés of its electrical undertaking. In the minutes of a Council meeting held on March 28th, when consideration was given to salaries and appointments in a number of the Council's departments, it is reported that "the new general policy of the Corporation is to arrange, or re-arrange, appointments and salaries within a fixed maximum, with a view to combined efficiency and economy."

Reading further, we find that the Electricity Committee, in adopting the sub-Committee's recommendations with regard to applications for increase in wages, has perfunctorily shelved the question for another 12 months, in so far as it concerns resident engineers, charge engineers, and switchboard attendants. The inconsistency of this decision, having in view the general policy of the Corporation, certainly savours of economy, but as regards efficiency, we hold a different opinion. Greater consideration, however, has been meted out to the mains superintendents in the three districts under the Council's jurisdiction. The salaries of these gentlemen, which at present range from £130 to £145, have to be increased by £5 per annum in each case. Advances of 1s. to 2s. per week have also been granted to the three shift engineers in the Burslem works, thus raising, in that station, the average wage of this class of employé from 35s. to 36s. 6d. per week.

The case of Stoke-on-Trent is by no means an isolated one. As a matter of fact, the same conditions will be found to exist in almost every city and town in the kingdom, and it is no wonder that great numbers of our young electrical engineers, on the completion of their apprenticeship or pupilage, and after spending a year or two as shift engineers or attendants in a power station, accept minor but more lucrative situations abroad, and leave the power stations of the home country in the hands of juniors and marine engineers grown tired of sea-going. Many instances could be cited where the chief engineer has pleaded with his committee to raise the standard of wages in his department, but without success. On the other hand, we understand that there are municipal chiefs who not only make no attempt to raise the standing of their subordinates, but even frustrate any efforts put forward with this intention by the assistants.

The tabulation of central station costs has become quite a fine art with municipal engineers, some of whom would almost risk their professional reputation to reduce their working charges by one-tenth of a penny per unit sold. After much scrutiny of the manner of burning coal at the station, and the possibility of cutting down the coal bill, and an inquiry into the superintendent's methods of tackling repairs, the chief finally arrives at the conclusion that something will have to be lopped off the wages item. We have a case in mind where an engineer, on taking over the management of a municipal undertaking in the North, had the existing members of the staff replaced by others at approximately two-thirds the salaries previously in vogue in the town. His brother engineers waited with considerable interest for the result of his first year's working with the new staff, which showed that although the wages costs per unit had dropped by 30 per cent., the increased costs per unit on coal and repairs items caused the total working charges per unit to jump up to an alarming figure. The reason for this was undoubtedly bad staffing, as the prices of coal and metals had not altered to any appreciable extent during the two years when the comparison was made.

A chief's time is taken up principally with the commercial side of the undertaking, while he exercises supervision over his departmental superintendents. He is therefore in large measure dependent on the ability of his engineers for the smooth and economical running of the plant, and a discontented shift engineer or superintendent can be the cause of greater losses to the undertaking than one might at first sight imagine.

We are in perfect agreement with the statements made by Mr. C. E. C. Shawfield at the farewell meeting with his staff at Wolverhampton on the 30th ult. In reply to several remarks regarding the application of profits towards the improvement of salaries and wages, he said that it was to be regretted that any money had been paid over to the relief of the rates, as he thought it was not in the best interest of department, or the town as a whole, that the profits of a trading undertaking should be used for this purpose. The first call on the profits should be to improve the status of employment, as the success or otherwise of the undertaking depended to a very large extent on the efforts of those employed therein. The chief, however—added Mr. Shawfield—had not a free hand in the matter of salaries and wages, but had to carry out the instructions of his employers—the municipality.

Fortunately the impropriety of robbing the electricity undertaking for the sake of relieving rates, upon which we have so often and so long insisted, is becoming more and more widely recognised, and amendment in this respect will, we hope, be accompanied by justice to the *personnel*.

An Agreement between Electrical Undertakers.

We publish elsewhere in this issue a report of the case of the London Electric Supply Corporation *v.* Westminster Electric Supply Corporation, which was decided last week by the House of Lords. For the convenience of those who have not time or inclination to study the whole case, we propose to give a summary of the decision, which appears to establish a very important principle in relation to that particular kind of transaction. We trust that no apology is necessary for repeating in a shortened form that which has been enunciated at greater length in the stately language of the House of Lords. To extract the kernel from a legal nut is not always easy. An old lawyer once told us that even with his experience he never understood a case until he had read it through three times. Let the following be regarded as the product of a frequent perusal of this important decision: The London Electric Supply Corporation and the Westminster Electric Supply Corporation, Ltd., are each authorised to supply electricity in parts of the Borough of Westminster, the "London" supplying alternating, and the "Westminster" continuous current. The Westminster Borough Council is entitled at a certain time to exercise the right to purchase the undertakings of both companies—the right in regard to the London falling to be exercised in 1931. In 1910, the London transferred to the Westminster the right to exercise their powers subject to the annual payment of £22,000, and to the right of the London to retain the purchase money at the date of compulsory sale, the Westminster agreeing to make up that sum to £100,000, if less were awarded.

It will be seen that, having regard to this agreement, the continued supply of alternating current was of importance to the London Co. In these circumstances they found it necessary, in 1911, to seek an injunction to restrain the Westminster Co. from soliciting customers who took alternating current to take continuous current. They also sought a declaration that, having regard to the agreement, the defendant company were bound to supply alternating current to any person in Westminster who might apply to the plaintiff company for such a supply. To put the matter in a nutshell, it appears that the Westminster Co. claimed, in effect, the right to act as if they were purchasers of the London Co.'s undertaking. In other words, they claimed the right, if so minded, to supply continuous current to all consumers, and to do that which would ultimately have destroyed the goodwill of the London Co. in the area. The judge of first instance and the Court of Appeal both refused to grant an injunction or to make any declaration; but the House of Lords has reversed this decision. The Lord Chancellor, in giving judgment, pointed out that the sale of an electrical undertaking was prohibited; that he could not treat the agreement as an arrangement under which the respondents had purchased for fixed sums the appellants' undertaking in the area, with freedom to do what they pleased with it. Finally, he declared that the Westminster Co. were bound, without prejudice to their right to carry on and develop their own undertaking in a fashion consistent

with their obligations under the agreement, to do nothing while the agreement lasted which would destroy the appellant's undertaking within the area. In the event, the House of Lords made a declaration to the above effect, holding that it was unnecessary to grant an injunction, as it was certain that the Westminster Co. would loyally act in accordance with the law as thus declared.

The principle to be drawn from the case may be thus briefly stated: Where undertakers, having power to supply electricity in a district, transfer their rights to rival undertakers supplying electricity, on the terms of a money payment, and on the terms that when compulsory purchase takes place, the purchase price shall be paid to the first company, the second company must not attempt to do anything which will destroy the goodwill of the first company.

We have been at pains to expound this decision as clearly as possible, inasmuch as the arrangement come to between these two companies is one which may at some future period be considered desirable in other districts.

Exhibitions at Glasgow and Sheffield.

Two important exhibitions are being organised for the autumn of 1913.

One will be exclusively electrical—at Glasgow, and the other largely so—at Sheffield. They will run concurrently, though the former will open a day earlier than the latter, that is, on Thursday, October 23rd, and both will close after three weeks' duration, on Saturday, November 15th.

The literature that has just been officially issued regarding both undertakings suggests that they will be business-like displays calculated to popularise the lighting and industrial applications of electricity if appropriate action be taken.

Glasgow has already had a couple of Smoke Abatement Exhibitions, but these are admitted to have applied to only one or two sides of the electrical industry, and the Corporation now feels that the time is ripe for holding in the Zoo Buildings a purely electrical exhibition (incorporating engineering and machinery), at which it is intended to include examples of all branches of electrical engineering, making a show which will "be at once worthy of the Second City of the Empire and of one of the youngest and greatest industries." It will be under the auspices of the Lord Provost and the Electricity Committee, with Mr. W. W. Lackie, of course, as electrical engineer. A feature of convenience from an exhibitor's point of view is the decision to have stands of uniform design erected by the Corporation, the cost being included with the charge for floor space; current will be provided free. It is intended to take advantage of the educational value of the cinematograph by displaying films of the latest uses of electricity, which manufacturers are invited to provide, in a hall which will be specially built for the purpose. There will also be lectures as well as special daily demonstrations of electric cooking, baking, bread-making, sick-room cooking, fancy bread making, and sweet making. It is considered by the authorities that the time is opportune for making, before the people of Glasgow and district, a powerful demonstration of the progress that has been made in telephony, lighting, power, heating and cooking, and as we have always thoroughly believed in properly organised exhibitions as a means of stimulating electrical interest, and have urged electricity supply authorities to adopt up-to-date business-getting methods, we wish every success to the Glasgow Corporation venture, and refer our readers to Mr. J. M. Freer, of 38, Bath Street, Glasgow, who has been appointed general manager.

In regard to the Sheffield undertaking, this is a Fuel, Light and Power Exhibition, which will be held in the City Exhibition Hall, under the auspices of local Health and Smoke Abatement Societies, and with the patronage of the Lord Mayor, the Master Cutler, and the president of the Sheffield Chamber of Commerce. The Advisory Committee includes Mr. S. E. Fedden, the manager of the Corporation electricity department; Mr. T. Scott Anderson, and Prof. W. Ripper, of the University. From the electrical point of view, the event may not at first appear to be so important as the Glasgow display, and electrical ardour may be damped somewhat by reading in the preliminary prospectus, that the Hall "is well lit with high-pressure gas," but while at Glasgow electricity will have no would-be rival in the Zoo buildings, at Sheffield it may be put upon its mettle. For instance, in the "Fuel" Section, "Electricity for Cooking" follows "Gas Stoves and Ranges for Cooking," and in the "Light" Section, "Electricity for Lighting and Heating" is sandwiched between certain gas and acetylene lines. By way of compensation, in the Power Section, electric motors and electric generating plants are allowed to lead, gas, oil and steam engines following. To some of our readers it may appear that this mixing up of different classes of lighting and power agents in one exhibition render it all the more important that electricity should make a strong showing.

Of course, the Sheffield management's idea is to lessen the smoke nuisance of that great industrial centre, and there is room for means many and varied, electrical and non-electrical, to obtain that very desirable result. No doubt the Sheffield Corporation Electricity Department will make an effective display of its own, and we trust that the exhibition will bring on many new consumers of all classes. Electrical firms who are interested should communicate with the hon. secretary, Mr. Wm. Bashford, at the Exhibition offices, 45, Bank Street, Sheffield.

Electrical Benevolence.

We make no apology for again reminding our readers that the annual Festival Dinner of the Electrical Trades Benevolent Institution will be held on Wednesday next, and urging them to lose no time in conferring effective support upon a movement which, above all others, merits their approval. The spirit of co-operation is in the air; it makes its influence felt throughout the world, from the highest to the lowest. European Powers, Oversea Dominions, Cabinet Ministers, British manufacturers, suffragettes, central station assistants—all feel the need of combining for mutual assistance and support in furthering their various aims, and the electrical industries ought to regard it as a sacred duty to their weaker members to co-operate in making provision for the relief of their necessities. As Mr. Garcke pointed out last week, the industry is not doing anything like as much as it ought to do towards this end; whereas there is a capital of 500 millions sterling invested in electrical concerns, employing nearly half a million souls, there is no more than a beggarly £4,000 in the coffers of the Benevolent Institution, the interest on which is quite inadequate to cope even with emergency grants, let alone the granting of pensions. If only the 6,000 firms engaged in the business would contribute on the average the trifling sum of one guinea each per annum, the Benevolent Institution would at once be put into a position of prosperity; surely it is not much to ask?

We do not, and cannot, believe that the will is wanting; the fact is, we think, that the interest of the vast majority of these firms has never been effectively aroused, although every effort has been made by the organisers and the Press to direct their attention to the Institution and to the benefits which it desires to confer upon the victims of unforeseen calamity and misfortune — benefits which cannot be secured in any other way. If the employés themselves would contribute the sum of *one penny each per annum*, the Institution would double its present capital every two years. How insignificant a contribution—and yet what magnificent results it would ensure! If only one good voluntary organiser could be obtained in every important centre to arrange for the collection of this trifle, a new era would dawn for the Benevolent Institution.

But this by the way. The immediate question is—the dinner. The chairman, Mr. George Sutton, has done splendid work for the cause—let it not be said that he lacked the support of his friends, each and everyone of whom, whether he realises it or not, is saddled with a real and personal responsibility in this matter towards his less fortunate neighbour.

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SALARIES IN MUNICIPAL UNDERTAKINGS.

[COMMUNICATED.]

In the Electrical Review of February 28th, 1913, a comparison was given of the wages paid to shift engineers and switchboard attendants in numerous central stations throughout the country.

A study of the salaries paid to chief electrical engineers and their principal assistants, and the relationships which exist between their total emoluments and the capacity, output and value of the undertaking, will elicit many facts and figures of personal interest, not only to those who at present hold those appointments, but also to the charge engineers, switchboard attendants and other employés who hope to fill the higher positions on the staff in years to come.

TABLE I.—Salary of Chief Engineer.

Municipal undertakings. Plant capacity.	No.	Per 100 kw. of plant.	Per 100 kw. connected to mains.	Per 100 kw. of maximum load.	Per 100,000 units sold per annum.	Per £1,000 of capital.	Per £1,000 of revenue.	Per 1,000 of population.
1,000—3,000 kw.	(1)	£20	£21	£57	£35	£5·0	£40	£6·6
	(2)	30	13	46	29	3·6	31	12·0
	(3)	31	21	56	58	3·3	30	9·1
	(4)	23	14	42	33	2·3	19	9·5
	(5)	29	15	44	32	3·4	29	8·0
	(6)	24	9	23	12	7·2	29	5·4
	(7)	21	9	43	33	2·5	20	8·5
	(8)	9	6	17	10	2·2	21	7·1
3,000—5,000 kw.	(9)	21	12	33	16	3·6	21	5·0
	(10)	16	10	31	19	3·0	19	3·9
	(11)	12	6	19	12	2·8	19	4·7
	(12)	17	9	23	12	2·1	16	3·6
	(13)	19	8	24	14	2·5	17	5·1
	(14)	18	9	26	22	3·2	21	11·9
	(15)	12	7	19	11	1·8	15	6·2
	(16)	9	5	11	7	1·3	9	2·8
	(17)	11	7	32	16	2·2	25	5·8
	(18)	12	9	25	15	1·7	17	3·0
	(19)	11	7	18	15	1·5	11	2·1
	(20)	16	7	19	11	1·7	15	4·0
	(21)	14	5	14	6	2·0	12	3·7
	(22)	16	8	21	11	2·1	16	3·7
5,000—10,000 kw.	(23)	12	5	20	9	2·3	15	6·1
	(24)	11	6	17	9	1·8	10	3·4
	(25)	10	7	20	10	1·8	16	4·8
	(26)	9	4·3	11	7	1·5	9	2·0
	(27)	9	4·0	13	7	2·0	12	3·5
	(28)	7	4·1	11	5	2·3	11	7
	(29)	8	4·3	12	5	2·3	13	6
	(30)	8	7·1	17	8	3·1	17	5
	(31)	5	4·3	7	4·2	1·5	9	4·2
	(32)	10	7·0	18	8	2·2	17	6
10,000—40,000 kw.	(33)	6	4·1	8	4·3	1·7	9	1·7
	(34)	7	2·9	9	6	1·0	10	1·8
	(35)	6	3·5	9	5	1·1	8	2·1
	(36)	5	2·6	7	5	0·8	7	2·5
	(37)	6	2·0	6	3·1	0·7	5	2·2
	(38)	2·6	1·8	5	2·7	0·6	4	1·5
	(39)	2·5	1·6	4	2·3	0·4	3·7	1·2

On what bases are the salaries of chiefs and assistants fixed? Very often the settlement of the chief's salary is limited to a consideration of purely local conditions, and no external influence is allowed to enter the question. In many cases, however, when an increase of salary has been requested, the chief himself inaugurates a crusade for the purpose of ascertaining the salaries paid to his *confrères* in other towns of approximately similar size, or having an output comparable with that of the undertaking which he controls. Having obtained the desired particulars, he carefully weeds out information that should be withheld from his committee, and the remaining data are embodied in a report showing how small his salary looks in comparison with the salaries of chief engineers in other undertakings, and how important his department is when compared to the electrical departments in other towns with approximately the same population. The matter will then be decided by a committee of gentlemen who probably have no electrical knowledge, and who are not aware of the responsibilities which rest upon their electrical engineer. The ultimate fate of the application sometimes depends, in a greater or less degree, on the relationship, harmonious or discordant, which exists between the engineer and his committee or its chairman.

Many chiefs of departments are allowed to practise at private consulting work, while others are granted the privilege of engaging premium pupils and retaining the premiums for themselves. There are managers, too, who, even in the face of greatly increased responsibility through the growth in the size of the undertaking, steadily oppose, as unnecessary and superfluous, all suggestions of the appointment of a chief assistant, so that thereby their own positions may be strengthened. It should be recognised that where the capital value of an undertaking exceeds £100,000, an assistant manager and engineer should be appointed, to take entire charge and have absolute responsibility for the working of the plant in the absence of the chief.

With the object of tracing the connection between the capacity, &c., of a municipal station and the salaries paid to officials in charge, the accompanying information relating to 39 undertakings has been extracted from the latest returns in the Electrical Review Tables, and the "Personal" and "Situations Vacant" columns of the same journal during the last few months.

Table I contains particulars regarding chief engineers' salaries in the 39 towns, expressed in pounds per annum for each 100-kw. capacity, mains connections and maximum demand respectively, and also per £1,000 of capital, £1,000 of revenue and 1,000 of population in the area of supply.

TABLE II.—Salaries of Assistants.

Municipal undertakings. Plant capacity.	No.	Chief assistant. Ratio to chief engineer's salary.	Mains engineer. Per 100 kw. connected.	Chief clerk. Per £1,000 of revenue.	Station engineer. Per 100 kw. of plant.
1,000—3,000 kw.	(1)	·50	£8·5	£10·6	£10·4
	(2)	·39	—	9·2	—
	(3)	—	11·1	7·0	9·2
	(4)	—	6·4	10·2	11·1
	(5)	·36	4·9	8·4	—
	(6)	—	2·2	5·4	6·0
	(7)	·53	4·0	6·1	6·0
	(8)	—	2·5	6·7	4·3
3,000—5,000 kw.	(9)	—	3·6	3·9	6·4
	(10)	·40	3·1	3·6	5·0
	(11)	·50	2·2	7·1	4·1
	(12)	·39	—	4·6	4·4
	(13)	·50	—	5·1	6·9
	(14)	·29	2·1	3·8	4·1
	(15)	·60	—	7·2	3·8
	(16)	—	1·6	3·6	4·0
	(17)	·44	2·1	6·6	3·7
	(18)	—	4·5	6·4	5·4
	(19)	·40	2·5	4·6	—
	(20)	·32	2·2	4·3	5·0
	(21)	·50	1·6	4·0	4·4
	(22)	·43	—	3·9	4·2
5,000—10,000 kw.	(23)	·35	—	2·4	3·5
	(24)	·50	2·3	3·9	4·2
	(25)	—	2·4	4·0	3·5
	(26)	·50	1·5	2·8	3·1
	(27)	·42	1·3	3·7	3·3
	(28)	—	1·2	2·6	2·5
	(29)	·26	0·8	3·8	2·2
	(30)	—	1·9	4·5	2·7
	(31)	·44	—	3·8	2·4
	(32)	—	1·5	3·5	2·1
10,000—40,000 kw.	(33)	·52	1·4	2·6	1·9
	(34)	·50	0·9	2·4	2·7
	(35)	—	1·0	2·6	—
	(36)	·47	0·9	1·1	1·7
	(37)	·28	0·7	1·5	1·7
	(38)	—	—	—	—
	(39)	·60	0·6	1·4	0·8

As the plant capacity of a station usually represents the status of that station, the 39 undertakings have been arranged in the order of their generating powers, and the curves in figs. 1 and 2 have been included to indicate graphically the extent of the variation of the values in Table I from the smaller works, with 1,000 kw. of plant or thereabouts, to the 40,000-kw. stations. It will be noted that the fluctuations of all seven sets of values follow closely the line of the curve known to station engineers as the "Capital cost per kilowatt" curve.

The minimum, average and maximum values of the above figures are as follows :—

Salary of chief engineer :—	*Minimum.*	*Average.*	*Maximum.*
Per 100 KW. of plant	£2·5	£13·1	£31
Per 100 KW. of connections ...	1·6	7·2	21
Per 100 KW. of maximum load	4·0	21·5	57
Per 100,000 units sold... ...	2·3	13·6	58
Per £1,000 of capital	0·4	2·2	7
Per £1,000 of revenue ...	3·7	16·1	40
Per 1,000 population	1·2	4·9	12

In figs. 3 and 4 the curves show the average total salaries of chief engineers in comparison with the power plant in the

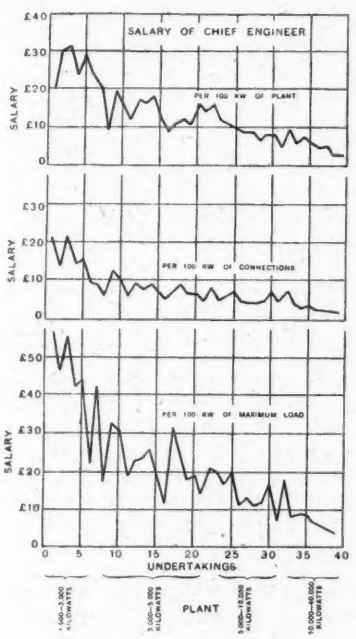


FIG. 1.

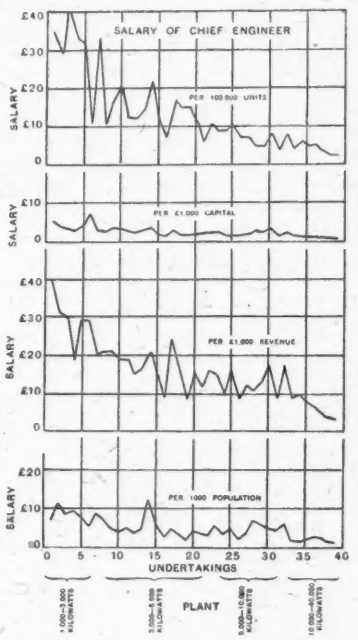


FIG. 2.

station, the capital cost of the undertaking, and the units sold per annum. A striking similarity will be seen to exist between the "plant" curve and the "units sold" curve, which would seem to show that the load factors of these stations do not vary to any great extent.

Assistants in electrical departments have, as a rule, many grievances, real and imaginary. These most often arise from discontent over the magnitude of their work, and the meagreness of their remuneration. As the undertaking expands in size and importance, and the chief's salary is augmented in like proportion, the assistants, who possibly do

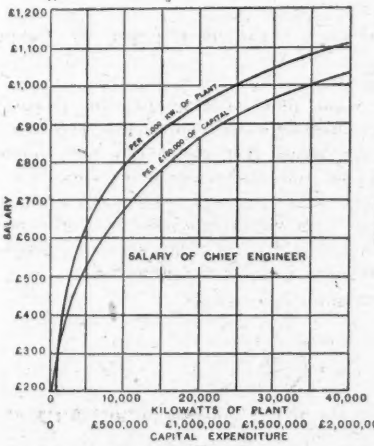


FIG. 3.

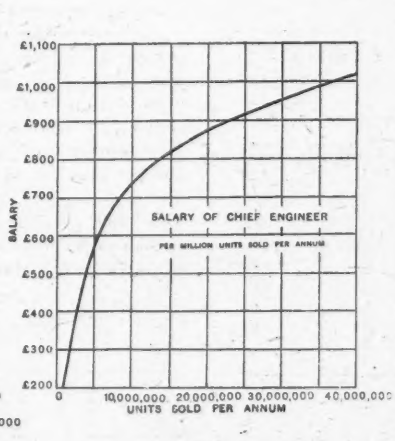


FIG. 4.

the bulk of even the administrative work of the department, may be entirely overlooked. Where the chief is the autocratic controller of the whole staff, including the chief assistant, the standard of discipline has certainly proved to be better than if several of the assistants are directly under the Electricity Committee, but the assistants have not the same opportunity of improving their positions on the staff as they would have if they were responsible to the Committee instead of to their chief.

It is quite common to hear of a chief engineer absolutely forbidding his assistants to engage in private consulting work in their leisure hours, while he himself openly accepts fees for specifications which may not improbably have been drawn up by one of his assistants.

As the chief assistant is of next importance to the chief, he should have a salary worthy of the responsibility he has accepted. In the third column of Table II the ratio of the chief assistant's to the chief's salary is given for as many of the 39 undertakings as have a chief assistant. A glance at the tabulated figures will show that out of the 39 stations, 13 have no assistant, while in six of them, the chief assistant also acts as mains engineer. In some of the columns blanks have been left where the information is not available. It will be observed that a common rule evidently adopted in fixing the assistant engineer's salary is to make it one-half of the chief's salary. Out of the chosen 39 towns, in as many as seven, the chief has a salary exactly double the amount of his understudy's.

The topmost curve in fig. 5 delineates the diversity of the ratios between the assistant's salaries and the chief's, while the other three lines represent the variations for the various undertakings of salary of mains engineer per 100 KW. of mains connections, salary of chief clerk per £1,000 of revenue, and salary of station superintendent per 100 KW. of plant installed.

The minimum, average and maximum values for these items are :—

	Minimum.	*Average.*	*Maximum.*
Ratio of chief assistant's to chief engineer's salary	·26	·44	·60
Mains engineer's salary per 100 KW. connected	£0·6	£2·7	£11·1
Chief clerk's salary per £1,000 of revenue	£1·1	£4·7	£10·6
Station engineer's salary per 100 KW. of plant	£0·8	£4·3	£11·1

The chief clerk's sphere is the supervision, under the chief engineer, of all office work—such as the issuing of energy and other accounts, the checking of invoices for goods purchased, and the general book-keeping of the department. Correspondence on non-technical matters may also be included in his tasks, as well as the filing of all records relating to the undertaking. Generally he acts as secretary to the chief engineer, and, in certain instances, he is also the collector of all moneys due to the department. His salary will naturally be in proportion to the duties appertaining to his office. It is assumed in this comparison that he controls the cash transactions, being, of course, dependent in this connection only on the City or Borough Treasurer. Comparing his salary with the income from all sources, the fluctuations in pounds per £1,000 of revenue are clearly shown in the curve.

The most satisfactory basis on which to compare the salaries paid to station superintendents is the total generating capacity of the plant for which they are responsible. In some cases the superintendent has charge only of the running of the plant, the repairs being placed in the hands of an independent engineer. In other power stations dual responsibility exists for the running and maintenance, the dividing line being drawn

between the electrical and the mechanical portions of the plant. The best results are obtained, however, where a good all-round mechanical and electrical engineer is

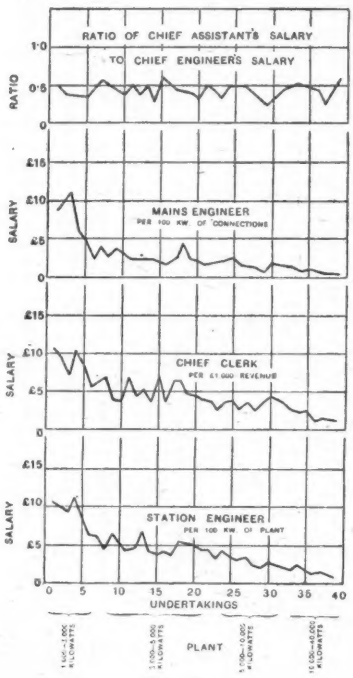


Fig. 5.

placed in absolute charge of the running of, and repairs to, all the appliances and machinery at the generating station.

As opportunity seldom arises for assistants in electricity undertakings to compare their wages with those of a number

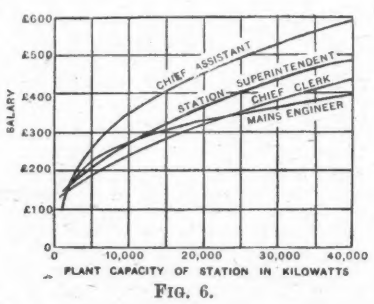


Fig. 6.

of other towns, in the same manner as chief engineers are privileged to do, the curves in fig. 5 may be of some interest to them. With a view to arriving at average values for different sizes of stations, the average results obtained from

Capacity in kw.	Chief engineer.	Chief assistant.	Mains engineer.	Chief clerk.	Station engineer.
1,500	£320	£150	£150	£150	£150
2,500	450	200	180	160	170
5,000	620	260	230	190	200
10,000	800	350	270	240	260
15,000	880	400	310	290	320
20,000	950	460	330	320	380
30,000	1,000	520	360	380	430
40,000	1,100	580	390	440	480

fig. 5 have been plotted in fig. 6. Reading from the latter curves, the accompanying table of average salaries for different sizes of stations has been compiled.

Meter Approved.—The Board of Trade has approved of the Chamberlain & Hookham polyphase watt-hour meter, type A.I.T., deposited by the makers in February, 1912.

THE COST OF HOUSE SERVICES.

By "IMPROVER."

Very little has been written in connection with the all-important item of house connections and their cost. The amount of money spent annually on this class of work must have a considerable bearing on the efficient running of mains departments, whether company or Borough Council; and yet very little attention is paid to this important spending department.

As is usual with the ordinary operation of a service-laying gang, the foreman of the department pays a visit to the premises about to have a service laid on, and measures up the amount of cable required for the job, and the usual requisition goes into the stores. Care has to be exercised in choosing the run, and accurate measurements are necessary, as the writer has frequently seen cases where the amount of cable brought on the job has been considerably in excess of all ordinary requirements, and anything from two to three yards has been returned as scrap ends.

Twelve years ago, the whole of the service work of a certain undertaking was carried out by one of the cable companies, and, in spite of the special supervision which was supposed to exist, the cost of services was quite out of all proportion to the length of any particular service, some of the reasons being :—(1) The price charged for service boxes; (2) cut-outs; and (3) waste labour.

The service boxes were of a type that had fuses controlling the installation, and were fitted with glands for plumbing to the outer sheathing of the lead-covered cables. The boxes were supposed to be the best of their kind at the time, but they have since been proved to be a nuisance through the fuses giving trouble. Many cases occurred where the fuses were found to be eaten through, and this, together with other complaints, caused them to be discarded. The cost of these boxes was £1 8s. each.

The use of such a box on a conduit system of distribution meant the building of a brick pit with a frame and cover for easy access, the cost being £1 9s. in each case.

The type of cut-out used, regardless of make, was a somewhat costly piece of apparatus, but in most cases the workmanship was good and the whole thing was reliable.

The labour was a very variable amount, and little judgment was exercised in setting out a day's work. In consequence there was a great deal of what the writer regards as waste labour, by which he does not necessarily mean loafing. This, together with hasty measurements of cable and consequent waste, completed what was a very costly job.

In more recent years the prices of joint boxes and cut-outs have decreased considerably, and at the present time a good joint box can be obtained at a few pence over 5s. Cut-outs, too, have decreased in price to the same low level, the workmanship being quite good and the cut-outs quite substantial in every way. The abolition of boxes that contained fuses having done away with the necessity of frames and covers, led to an improvement in cost of about £2 3s. per service.

In dealing with waste of time, the writer has in use a system of service connections which reduces this waste to a minimum, by the use of a cast lead shell for service boxes. At the same time use is made of all scrap lead stripped from the ends of cable returned to stores from the various works. This shell, in addition to providing the usual protection and receptacle for the compound, forms a continuous lead sheathing, and its value as such must be obvious to all.

It frequently happens that the service gang cannot begin operations until about 7 a.m. in the case of private houses, and, perhaps, 9 a.m. in the case of shops. The jointer and mate are, consequently, compelled to wait about until one end of the cable is fixed in the basement of the premises (unless some "hospital" job can be found for them). This gives a considerable amount of time that can be profitably utilised, and is so utilised where the system of casting lead carcases is in vogue. The preparation of metal and moulds is quite a speedy process, and sufficient carcases can be turned out during the waiting period of the ordinary jointer's day. After a careful study over several months, it appears that the cost of turning out these carcases amounts to :—Labour, 9d. per set; lead (if at scrap value), 1s. 6d.

per set, and if new lead 1s. 10d. per set, or not more than 2s. 7d. per set of two halves. Together with fitting, this completes a very cheap service box.

The cost of connecting or fixing is no more than that of the ordinary cast-iron shell, and a jointer and mate can, during the early morning, cast three sets of six halves and fix and complete three service boxes and cut-outs during one working day of 9½ hours where the mains are clear.

The only process is that of laying a strip of prepared tape along the joints of the two halves of the boxes and applying a powerful blow-lamp for 15 minutes. This also serves the very useful purpose of warming up the joint-box and keeping the compound in a very fluid state for a considerable time, and allows any air to escape. The sealing and completing of the box is done by laying a small sheet of metal over the opening in the top half.

As a means of checking the scrap cable sent in, a book is kept in the stores, and the jointers' mates return daily all ends from the completed jobs, which materially assists the stores clerk in keeping an accurate record; this used to be a very troublesome task and meant much "cooking" of cable measurements.

Below is given a record of the cost of service laying complete with reinstating charges, at various periods from 1901 to the present year, the service laying being done by a contractor from 1900 to 1902, and by the Council's employés from 1903 to date. In the case of all services laid prior to 1907, both by the contractor and Corporation, wrought-iron pipes were used to draw the cable through from the Council's mains to the consumers' basements. From 1907, the cable used has been strip armoured, and here there is a slight saving of about 3d. per foot run. In the case of armoured cable services, the mains are laid at an increased depth to avoid damage to the mains by other mains layers, who are many and have not always the respect for electric cables that they might have.

In 1901 a service was laid by the contractor (and is representative of those of its class). The length of cable was 45 ft., and the cost was as under :—

45 ft. '05 L.T.C., and W.I. pipe	£3	10	0
Box and cut-out, stores, jointing, materials, &c.	3	3	0
Brick pit, frame and cover	1	9	0
Paving	1	0	0
Total	£9	2	0

In 1903 a service was laid by the Council's men, the joint box and cut-out being identical, and the method of laying the cable the same as in the previous case. The cost worked out as follows :—

45 ft. '05 cable in 1½ in. W.I. pipe	£3	8	4
Box and cut-out, stores, jointing, materials, &c.	2	12	4
Brick pit, frame and cover	1	6	0
Paving	0	19	6
Extra for meter-board fixed by Council ...	0	4	0
Total	£8	10	2

In 1907, using armoured cable, a non-fused type of joint box, and a much cheaper, though equally good cut-out, a service was laid costing :—

45 ft. '05 armoured cable	£2	17	0
Box and cut-out, jointing, materials, stores, and "blind" brick-box	2	0	0
Paving	0	19	9
Total	5	16	9

Here a brick pit was built, but a frame and cover were not needed. A slab of York stone was placed over the box just under the paving, and a mark peculiar to the department was cut into the wall of the premises to indicate the point of entry.

From this date the services cost less, mainly owing to the reduction in the price of service boxes and cut-outs, the cheapening of compound, the better manipulation of the various gangs, and the sandwiching-in of other useful work, until in 1909 we had services of 40-ft. run costing :—

40 ft. 7/18 cable	£1	1	3
Joint-box	0	4	9
Cut-outs...	0	4	9
Meter-board	0	1	8½
Stores, compound, &c	0	2	4½
Labour	1	7	6
Paving	0	12	8
Total	£3	15	0

A service laid the same year, but having a larger size cable, cost :—

45 ft. '05 cable...	£1	17	11
Joint-box	0	4	7
Cut-out	0	4	9
Meter-board	0	1	9
Stores	0	2	6
Labour	1	3	7
Paving	0	19	7
Total	£4	14	8

Since 1911, the new method of joint boxes has been in vogue, and the cost of services has worked out at an average of :—

35 ft. 7/18 cable	£1	0	5
Box fitting	0	1	7
Box carcase	0	2	6
Cut-out and meter-board	0	6	2½
Labour	0	10	6
Total	£2	1	8½

Thus it will be seen that marked improvements have been made in cheapening the cost of services, this being primarily due to the better setting out of work and the consequent reduction in the cost of labour, and the cheapening of service boxes and cut-outs.

In the case of the first service mentioned we had a cost of £3 8s. 4d. for cable and laying, exclusive of paving, or 5s. 4d. per yard run. Of this amount, 3s. 7½d. per yard was for cable and wrought-iron pipe, laid and jointed. The balance of 1s. 8½d. per yard was for laying service line only. This should have shown a very fine return, as some hundreds of connections were made in the year, and the fact has also to be taken into consideration that only 24 ft. of ground had to be opened, the balance of cable being simply cleated to the wall of the consumer's basement. The cost of the service box and cut-out was £2 12s. 4d., including fixing. Of this sum, 10s. 8d. was for fixing only, leaving a figure quite in keeping with the charges for electrical apparatus in those days.

As a fair comparison, I place alongside the above a service laid by the Council's men in 1909, the size and length of the cable being the same, with the exception that armoured cable was used. The cost of this service was £1 17s. 11d., or 3s. 11d. per yard. Here the service box cost 9s. 4d., exclusive of fixing, which was an immense saving on the old charge, while the quality was good. Of the labour charge of £1 3s. 7d., the sum of 6s. 3d. was for the time of the jointer and mate fixing service box, meter board and cut-out. The balance of 17s. 4d. was for excavating, laying cable and building "blind box" (the system is a draw-in one). This represents an all-in price of 1s. 3½d. per yard, which must be regarded as a great improvement.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Maintenance of Tramway Rolling Stock.

Referring to the interesting article on "Some Difficulties with Tramcar Motors," in the issue of the Electrical Review for the 28th ult., I beg to suggest that it contains some food for reflection for those tramway managers who are anxious to maintain reliability of service and efficient running of the rolling stock.

Undoubtedly the receipts per car-mile and the ratio of receipts to expenses, &c., are important items in tramway management; but it is to be feared that in some undertakings the commercial aspects overshadow, to a large extent, the technical or engineering considerations, with the unfortunate result that the rolling stock is apt to receive less skilled engineering supervision than is desirable to secure the most efficient results.

It is not uncommon either to find that the car-shed staff consists principally of "fitters" whose training and wages are inadequate for the work that generally devolves upon them, for it is often supposed that rolling stock repairs can

be efficiently carried out by skilled labourers or fitters, with little or no training in shop methods or the use of tools, &c.

Indeed, in more than one instance, the writer has known the depôt staff to be under the control of men whose previous experience was acquired in a winding shop or in jointing on a lighting network; and although such men may eventually become efficient "fitters," it is more often than not at the expense of both the equipment and the time-keeping on service. It may be argued that "it would not pay to employ skilled fitters at, say, 8½d. per hour," but when one has had actual experience with "fitters" *and* fitters on rolling stock repairs, I venture to think that an analysis of the various items which compose the working expenditure will, in the majority of cases, amply prove that it pays to employ efficient men.

The best of traction equipments have a fairly low overall conversion efficiency under service conditions, and in these days of the extensive use of meters and methods of diagnosing inefficiencies, it is all the more surprising to find that in many cases so little interest is evinced in the condition of the mechanical details of the rolling stock from an engineering point of view.

L. Marshall Jockels.

York, *April 5th*, 1913.

Electric Laundry Irons.

I should be glad to hear, through your valued columns, from any of your readers who have discovered a practical electric iron for laundry or factory use. I have tried all the well-known makes, but cannot find one that will stand up without attention for more than three months. The chief difficulty is the disintegration of the copper of the flexible close to the connector terminals, due to the heat rising from the iron, which also destroys the rubber on the flexible, and causes short circuits.

Has anyone experimented in this connection with the brass flexible that was on the market some 10 years ago, and, if so, with what results?

Another fault with most irons is the way the connection is made between the heating element and the brass terminal pins. This is, as a rule, very crude, and has not the attention given to it which it deserves, the result being arcing, and eventually an open circuit.

These faults are, of course, not nearly so frequent in household electric irons, partly due to the lower temperatures at which they are run, and their intermittent use.

Ironical.

Electrical Shunt Calculator.

Referring to the description of an electrical shunt calculator on page 556 of your last issue, I would say that this is quite an old device for summing reciprocals. Its use for combining resistances was described some years ago in the American journal *Power*, and is also to be found in Peddie's "Construction of Graphical Charts." It is, of course, a particular example of the monographic diagram which M. Ocagne brought into prominence many years ago, and of which a large number has appeared in American journals from time to time.

It may be noted that the solution of this problem is quite readily effected by the slide rule, only one movement of the slide being necessary.

I trust this information may save Mr. Brown expending further time and trouble in this connection.

C. N. Pickworth.

Withington, Manchester, *April 4th*, 1913.

Prospects in Electrical Engineering.

I read with interest Mr. W. J. Ebben's letter in the current issue of your paper, and as a former teacher, with many years' experience, perhaps you will allow me to make a few remarks.

In London at present the "system" pursued by the London County Council in its numerous technical institutions is that associated with the name of Lancaster, and is as follows:—Number of students × hours = work done per annum. Anything tending to reduce this product is absolutely "taboo" at present. As for the merits of this system, they have already been dealt with, but it is extraordinary to find a system exploded many years ago still rampant in London.

Consequently the duty of the teacher is clearly to impress on all the students that the special system of teaching inaugurated by the L.C.C. is for the express purpose of increasing his "money-earning capacity"—a matter, no doubt, of great importance to people who know nothing of education.

W. H. F. Murdoch, B.Sc., M.I.E.E.

Millhill, Middlesex, *April 5th*, 1913.

Failure to Excite.

I should like to suggest, in reply to "Speedometer," whose letter appears in the "Correspondence" columns of your current issue, that the fact that his generator refuses to excite itself when run up to speed in the ordinary way may be due to the fact that one of the field connections is not making perfect contact, with the result that the initial low voltage induced by what is at first only remanent magnetism is not high enough to drive any more current through the shunt coils than is already passing, and that, therefore, the field cannot "build up."

This suggestion is supported by the fact that the machine runs O.K. as a motor.

I may say that I have had the same experience on more than one occasion, and, by tightening up the field connections after scraping them, have found the generator quickly build up its field.

When the machine was run as a generator with series turns on the fields, these were quite possibly opposing and overcoming the small effect of the shunt winding.

C. V. Peake.

Birmingham, *April 7th*, 1913.

Electric Heating and Cooking Apparatus.

The writer of the article under the above title in your current issue states that my "Pygmy" heater consumes about 200 to 300 watts, and I trust you will allow me to correct this statement, the actual consumption being from 125 to 140 watts.

Considerably over 10,000 of these little hot plates have now been sold, and whatever the technical man may think of them, it is an undoubted fact that they are well appreciated by the public. They serve as a useful object lesson in electric heating and cooking, and in exciting the interest of the public they may be looked upon as a very useful canvasser for business of a more ambitious nature.

The same writer states that the quartz type of element burns out very readily, and I think that his experience cannot have been obtained from apparatus made during the last two years. My quartz glowers do not burn out very readily unless they are greatly over-run, and the only trouble that has been experienced during the last two years has been with heaters used on alternating-current circuits, such trouble not being due to the burning out of the elements, but to failure at the terminals. This latter defect has now been entirely eliminated, and if the writer of the article will be so good as to test some of our recently-constructed apparatus, I am quite confident that he will be forced to adopt an entirely favourable view as to its reliability.

I have read with interest your editorial remarks on the subject of the electric heating of rooms, and it seems to me that the only golden rule that one can follow in connection with the design of apparatus for that purpose, is to imitate as nearly as possible the appearance *and temperature* of the glowing coal fire, the comfort of which, so far as physiological effect is concerned, is very generally admitted.

In the course of the recent discussion at the Yorkshire Local Section of the Institution of Electrical Engineers, on the subject of electric heating and cooking, Mr. H. Vesger said that he did not think any reasonable man would suggest

heating a house with radiators under present conditions of price of energy, but I am prepared to demonstrate to Mr. Vesger that heating by electricity at one penny per unit compares very favourably indeed with heating by gas at 3s. per 1,000 cb. ft. provided adequate ventilation is arranged in each case. The open coal fire is admittedly cheaper than electricity for heating continuously an ordinary living room, but it is absolutely useless for temporary heating, for which electricity can practically defy competition.

Surely the facts cannot be as Mr. Vesger would like us to believe! The tens of thousands of electric heaters that are sold every year are evidence that the public entertain a contrary opinion.

C. Orme Bastian.

London, E.C., *April 7th*, 1913.

Remote Control by Vibrations.

Among other interesting matter, your issue of April 4th contains descriptions of inventions relating to "Life Targets" and "Wireless Telephony in Mines," both of which include apparatus for governing a local circuit by means of vibrations, air being the medium in the first case, and ether in the second.

I had the pleasure in December, 1907, of showing you my method of effecting control of operations at a distance without solid connections, a sound being received on that occasion by a microphone transmitter in series with a battery and the primary of a small induction coil, the secondary of which was connected to the magnet illustrated on page 963 of the ELECTRICAL REVIEW of December 13th, 1907. A time relay was combined with a step-by-step motion by means of which a variety of actions were governed in a model torpedo. Without the time relay, the apparatus responds to sudden loud noises such as gunshots. The corresponding devices described in your last issue under the head of "Life Targets," bear some resemblance to those previously invented by me, as may be seen from a reference to your article of December, 1907, and to my Patent Specification No. 11,021 of 1906.

Your Mr. Gatehouse may recollect that a curious discovery was made at the time of his inspection of my instruments. A common deal box in which the microphone transmitter was enclosed, was found to have a pronounced natural period of its own—about 275 v./s. The instruments could sometimes be caused to respond to the pitch of the box when Mr. Gatehouse sang the appropriate note.

It soon became obvious to me that my membrane might be set in vibration by ether waves if its natural period were brought into correspondence with the train or group frequency of such waves. In this case the alternations passing through the magnet under the membrane were derived from a receiving aerial, instead of a microphone transmitter. The arrangement is the subject of my Patent 12,183 of 1906, and there appears to be little difference between it and the call device described in your last issue under the head of "Wireless Telephony in Mines."

J. Gardner.

Fleetwood, *April 5th*, 1913.

[In our article we pointed out that "the effect could certainly be produced by other means," having in mind such devices as those of Mr. Gardner's invention.—EDS. ELEC. REV.]

Replacement of Plant.

I should be glad to hear if any readers of the ELECTRICAL REVIEW have replaced old plant, the capital of which has not been fully paid off, out of their invested reserve fund, and if they have found any difficulties, legal or otherwise.

R. N. Torpy,
Borough Electrical Engineer.

Electricity Works,
Tunbridge Wells,
April 1st, 1913.

PARLIAMENTARY.

Coventry Corporation Bill.

A SELECT Committee of the House of Commons, presided over by Mr. H. Law, considered this Bill on April 2nd and 3rd. The chief object sought by the Bill had relation to the water supply, but there were also clauses to empower the Corporation to run motor-'buses, and to extend the area for the supply of electricity so as to include the parishes of Allesley, Binley, Coundon, Keresley, Stoneleigh, Walsgrave, Willenhall and Wyken. The estimated expenditure on motor-'buses was £11,200, and there was a further estimate of £3,800 for the erection of a garage. Mr. Hutchinson, K.C., and Mr. Jeeves appeared for the promoters, and Mr. Talbot, K.C., and Mr. Field for the Warwickshire County Council, and Mr. Maconachie for the Leicestershire and Warwickshire Electric Power Co.

The Warwickshire County Council opposed the running of motor-'buses over the main county roads outside the city, and after a consultation it was decided to withdraw all such routes.

The County Council also opposed the extension of the area for the supply of electric light, on the ground that there was no real necessity for such extension, which, if granted, might ultimately be used as an argument for the extension of the city boundaries.

MR. HUTCHINSON announced that all the electricity extensions would be withdrawn, except in regard to a part of Stoneleigh parish lying contiguous to the existing municipal boundary.

MR. MACONACHIE opposed the extension of the electricity supply powers to Stoneleigh, and called

MR. GEO. BALFOUR, of Balfour, Beatty & Co., Ltd., who stated that the Leicestershire & Warwickshire Electric Power Co. had completed a trunk line, which was to go *viâ* the outskirts of Coventry to Warwick; and he was also making a contract with the Leamington & Warwick Electric Co. to supply them with power from Hinckley. The company intended to apply for a provisional order for lighting, and would be prepared to supply Stoneleigh.

The Committee decided to allow the Corporation's proposal for extending their electric lighting area to the part of Stoneleigh parish defined.

On the consideration of the clauses, MR. MACONACHIE, on behalf of the Leicestershire and Warwickshire Electric Power Co., asked the Committee to insert a clause defining the position of the Corporation in regard to the supply of electricity in Stoneleigh. He pointed out that under the company's Act of 1902 the company was debarred from supplying electrical energy in the Coventry district without the consent in writing of the Coventry Corporation, and the object of the clause was to make it perfectly clear that the company would not need such consent when they exercised their powers to supply in the Stoneleigh district.

MR. PRITCHARD (Parliamentary agent for the Corporation) said no such protective clause was necessary, as the Bill took no power to extend the boundaries of the city.

The CHAIRMAN said the Committee would allow the clause of the company, although they thought it was somewhat superfluous. As some apprehension appeared to exist in the minds of the company, they would grant the clause, as it was not the intention of the Committee to place the company in any worse position with regard to the area in question.

The Bill was ordered to be reported for third reading.

Dundee Corporation Bill.—This Bill, which presumably has for its object the widening of streets, &c., came before the House of Commons Committee on Unopposed Bills on 4th inst., and was ordered to be reported for third reading. The Bill contains estimates for tramways to the amount of £13,000. To meet the wishes of the Scottish Office, the Corporation inserted a clause in the Bill providing that not more than £1,000 in any one year should be paid from the tramway receipts to the relief of rates.

LEGAL.

BUCKLEY & BEACH *v.* NATIONAL ELECTRIC THEATRES, LTD.

IN the Court of Appeal on Wednesday, April 2nd, Lords Justices Vaughan Williams and Hamilton heard an interlocutory appeal in an action brought by plaintiffs, electrical engineers, against the defendants, to recover moneys alleged to be due in respect of work done and materials supplied at three electric theatres, namely, at York, Hull, and Chatham.

MR. TINDAL ATKINSON, for the plaintiffs, said that his clients appealed from an order of Mr. Justice Bucknill in chambers reversing an order of Master Bonner. In October, 1910, the plaintiff and the defendants entered into a contract under which the former were to install electric light in defendants' theatre at York, the contract price being between £400 and £500. The work was completed in July, 1911, but the architect's final certificate was not given, and payment was not made until October, 1911. Rather more than 12 months after completion of the work at York, defendants suggested that there were defects, and the dispute between the parties was whether the defects were due to the faulty work of the plaintiffs originally, or whether they were due, as the

plaintiffs alleged, to negligent treatment of the installation by the defendants' servants. Plaintiffs, in consequence of the complaint, did certain work at the York theatre. About the same time they also did some work at the defendants' theatres at Hull and Chatham. Plaintiffs instituted proceedings, claiming against the defendants £33 11s. 10d., as to which £18. 3s. related to work at the York Theatre, and £15 8s. 10d. to work at the other two theatres. A letter was received from the defendants, complaining of the work at Hull, and saying that they would probably counterclaim in respect of it. Eventually two summons came before Master Bonner, one by the plaintiffs asking for summary judgment under Order 14, and the other by the defendants asking that the proceedings should be stayed by reason of an arbitration clause in the York contract. The plaintiffs' contention was that the work having been completed under that contract the arbitration clause had ceased to be effective. In the circumstances, Master Bonner remitted the whole action to the West London County Court. That, said Counsel, worked no injustice upon the defendants, because they could counterclaim as well in the County Court as in the High Court. Twelve days afterwards, after the plaintiffs had entered the case for trial in the County Court, the defendants appealed to Mr. Justice Bucknill. The appeal was out of time, but the learned Judge extended the time for appealing and then dealt with the matter on its merits. In the result his Lordship reversed the Master's order, stayed the whole action and referred the dispute to arbitration. Counsel submitted that the judge was wrong in making such an order. In the first place, he contended that the arbitration clause had ceased to be effective, and that in any event it did not cover the claim for the work at Hull and Chatham, and in the second place, the case having been set down in the County Court the judge had no jurisdiction to hear the appeal at all.

Mr. Pollock, K.C., who appeared with Mr. Newbolt for the respondents, supported the judge's order.

Lord Justice Vaughan Williams giving judgment allowing the appeal, said that when Mr. Justice Bucknill made the order he had no jurisdiction because the cause of action had been lodged in the County Court before the defendants issued their summons asking for an extension of time to appeal.

Lord Justice Hamilton concurred. He thought the appeal succeeded on both points.

The appeal was accordingly allowed with costs, and the order of the Master restored.

Trade Marks.

In the Chancery Division on Friday, April 4th, before Mr. Justice Swinfen Eady, Mr. Kerly said he had a motion on behalf of the Western Electric Co., Ltd., by way of an appeal from the decision of the Comptroller of Trade Marks. The parties, however, said counsel, had made arrangements of which the Comptroller approved, and he proposed in these special circumstances to withdraw his decision. That being so, he (counsel) asked to be allowed to withdraw his appeal.

His Lordship granted the application.

Electricity Supply in Westminster.

In the House of Lords on Friday last, before the Lord Chancellor and Lords Atkinson, Shaw and Moulton, judgment was given in an appeal by the London Electric Supply Corporation, Ltd., to which the Westminster Electric Supply Corporation, Ltd., were respondents. The facts and arguments were fully reported in the Electrical Review of March 7th, ante pp. 377-378.

Mr. Danckwerts, K.C., Mr. Buckmaster, K.C., and Mr. Austen Cartmell appeared in support of the appeal. Sir Robert Finlay, K.C., Mr. Younger, K.C., and Mr. W. S. Kennedy for the respondents.

The Lord Chancellor, in the course of his judgment, said that the case appeared to him to be not unattended with difficulty, but he had come to the conclusion that the judgment appealed against could not stand. The question was whether the agreement of 1910 was, as held by the Courts below, one under which the respondents were at liberty to manage the undertaking of the appellants within the Westminster area with the same freedom as they could have done had they been out and out purchasers for their own benefit. Put less abstractly, were the respondents left free to reduce the working of that undertaking by soliciting persons, who were entitled to apply, and did apply, to the appellants to supply them with electricity, to take their supply from the respondents instead? Were they further at liberty as between themselves and the appellents, to say to those who, under the terms of the appellants' Provisional Order of 1889, were entitled to claim a supply from the appellants, and subsequently to the agreement did so claim, that they, the respondents, had acquired the right to manage the appellants' undertaking as well as their own, had an option to tell these persons which supply they should have? In order to understand the meaning of the agreement, it was necessary to remember the state of legislation affecting these companies when the agreement was made. Sec. 11 of the Electric Lighting Act, 1882, had prohibited such companies from divesting themselves of their legal powers and liabilities as imposed by that Act, without the consent of the Board of Trade. The object was to maintain competition and avoid monopoly. The provisional orders of the appellants and the respondents, which were made in 1889, and were confirmed by Parliament, accordingly prohibited them from purchasing or acquiring the undertakings of, or from associating themselves with, any other company or person supplying electricity under any licence, provisional order, or special Act within London, unless authorised by Parliament. In 1908 by the London Electric Supply Act of that year they were authorised to enter into and carry into effect, with the approval of the Board of Trade, any agreement for mutual assistance or for association with each other in regard to, among other things, the giving and taking of a supply of electricity, and the distribution and supply of electricity so taken, and for the management and working of any part of their undertakings. It was to be observed that this permission did not in terms authorise purchase or transfer. Sec. 11 of the Act of 1882, and the orders of 1889, remained standing except so far as the words of the Act of 1908 relaxed their stringency. Sec. 11 was, indeed, afterwards repealed by Sec. 14 of the Electric Lighting Act, 1909, but its substance was re-enacted by the same section in rather more stringent terms. Under these circumstances, the two companies negotiated, and the Board of Trade approved, the agreement in question. It was dated May 4th, 1910, and consisted of 21 articles. His Lordship then referred to Article 2, which provided that the appellants were to place their undertaking in the hands of the respondents during the continuance of the agreement; to Articles 3 and 4 which referred to the upkeep of existing mains and the cost of extensions; to Article 9, reading of meters and collecting accounts, and Article 11, by which the respondents were, in a proper and efficient manner, to fulfil and comply with all the conditions and requirements in respect of supply to which the appellants were or might be subject within the area, and were to indemnify the appellants against claims for default of supply. Turning to Article 13, he said the appellants were to supply to the respondents such amount of alternating current as might be required for enabling the respondents to supply all the requirements of the appellants' consumers for alternating current within the area, and of all such other consumers within the area, as might be required for enabling the respondents to supply their own customers with current within the area. By Article 15, the respondents were to pay to the appellants in each year until 1931 the fixed annual sum therein mentioned, and, if the statutory purchasing authority did not purchase the undertaking in that year, a reduced annual payment thereafter until such purchase. By Article 16, the price to be paid to the appellants by the purchasing authority was to go exclusively to them and the respondents were to make up the amount payable for the portion of the undertaking within the area to £100,000 should it fall short of that sum. By Article 17, the respondents were, in addition to the annual payments already mentioned, to pay the appellants for electricity supplied under the agreement £2,000 a year to meet certain standing charges and ·85d. for each Board of Trade unit of electricity supplied. He also read Articles 19 and 20. The Lord Chancellor, continuing, said he agreed that the agreement must be read as a whole and its real substance sought for. It seemed to him that the construction sought to be placed upon the powers conferred by the agreement upon the respondents could not be upheld. He did not, however, think it necessary to grant an injunction at present. It would be sufficient, looking to the circumstances, to give liberty to apply in the action if such an injunction or other relief should prove necessary. He had had the advantage of considering the declarations suggested in the judgment about to be delivered by Lord Moulton, and he thought that the wording he proposed, with the addition of liberty to apply, was the proper form for such declarations to take. Accordingly, he moved that the appeal should be allowed, and as the respondents had been substantially wrong, they must pay the costs there and below.

Lord Atkinson concurred.

Lord Shaw read a judgment to the like effect.

Lord Moulton then read an exhaustive judgment dealing with the course of legislation, the agreement, and the grounds for the conclusion at which he had arrived. He said that the appeal raised points of general importance, as well as issues affecting only the parties to the suit. For the sake of clearness, it would be well to deal with matters in chronological order. His Lordship referred to the Act of 1882, the Act which still formed the basis of the legislation applicable to the subject, and said that no practical action took place under that statute, because of the shortness of the term which Parliament then was willing to give undertakers of electric lighting enterprises. By the Act of 1888, things were made more favourable, and many applications for provisional orders covering various areas of London were made in 1889, and among them those of the plaintiffs and the defendants. The plaintiffs' area was a very large one, and extended on both sides of the Thames. It included the district of Westminster. The system of supply was an alternating current generated at a station outside the area, the energy being transmitted at very high pressure to the districts of supply, and there transformed down to a low pressure. In 1908 it was felt that difficulties of establishing generating stations in populous districts, and the advantages of producing on a large scale, and with large units of machinery, rendered it advisable to make some concessions in the provisions aimed against monopoly in the statute of 1882 and 1889, and accordingly the Act of 1908 was passed to allow authorised undertakers of electric lighting to enter into arrangements as to certain matters with other electric supply companies. It was under the powers of that Act that on May 4th, 1910, the parties to this suit entered into the agreement out of which this action arose. The differences relative to the meaning and effect of that agreement might be summed up in two plain issues. First, the Westminster Co. claimed the right to use all means in its power, whether in the form of persuasion or by the exercise of powers possessed by it under and by virtue of the agreement, or the statutes regulating the undertakings, to detach customers from the London Co. and transfer them to the Westminster Co.; and, secondly, the Westminster Co. claimed the right to refuse to give alternating current

from the London Co.'s mains to members of the public having a right to be supplied by that company, and to compel them to take the Westminster Co.'s continuous current if they wished to receive a supply of electric energy at all. The first question, therefore, was, What were the powers and duties of the Westminster Co. with regard to that part of the London Co.'s undertaking which was situated in the Westminster area? Those powers and duties could only have been acquired by the Westminster Co. in virtue of the existence of corresponding provisions in the agreement. Those provisions must be within the powers given in the London Electric Supply Act, 1908, for, apart from that Act, no such powers or duties could have been acquired by the one company with regard to the undertaking of the other, either by agreement or otherwise. His Lordship said that this was evident by the chain of statutory enactments, which he proceeded to consider at some length, beginning with Sec. 11 of the Act of 1882, and tracing the changes, as referred to by the Lord Chancellor, brought about by the subsequent statutes. He referred to Sec. 4 in each of the Provisional Orders under which the companies respectively worked their undertakings, which provided that "the undertakers shall not purchase or acquire the undertaking of, or associate themselves with, any other company or person supplying energy under any licence, provisional order, or special Act within the Administrative County of London, unless the undertakers are authorised by Parliament to do so." Before examining the agreement of May 4th, 1910, in detail, it was necessary to state shortly the position of the two companies with respect to the nature of the supply that they were respectively authorised and compelled to give to the public. The Westminster had from the first sought, and obtained, powers to supply to the public low-tension continuous current only. From the first the London had adopted the alternate current as its form of supply, and down to the year 1905 it was not authorised to give any other form. In June of that year it obtained powers for an additional system—namely, an extra-high-pressure alternating-current supply to motor-generators placed in substations erected above the ground, and from those motor-generators a continuous-current low-pressure supply to the public by means of conductors on the three-wire system. But although they had acquired such powers, they availed themselves of them only in districts south of the Thames. In Westminster, for instance, they neither installed the requisite motor-generators nor laid down any mains for such supply, which required separate mains of a different construction to the company's mains in that area. It followed, therefore, that in the Westminster area they remained as they had been from the commencement—a company supplying to the public alternating current only. His Lordship then referred to the recitals in the agreement, and said that the main provisions which dealt with the "giving and taking of currents" were to be found in Clauses 13 and 14. The monetary terms of the agreement were as follows:—The Westminster Co. was to take the whole of the customers' payments, *i.e.*, the entire revenue produced by the London Co. in the Westminster area. In return it made a fixed annual payment of an amount to be ascertained once for all in a manner specified in the agreement. It was argued by the parties that this had been done, and that the sum so ascertained amounted to £21,735 per annum. It also paid for all the alternating current supplied by the London Co. under the agreement at the rate of '85d. per unit. And, finally, it paid £2,000 to the London Co. to meet the standing charges of the London Co. for the maintenance, renewal and upkeep of the works handed over to the Westminster Co. under the agreement. It then came to be considered the bearing of the various recitals he had referred to on the points at issue between the parties. With reference to the first question—What was the effect of the Westminster Co. taking over the "management and working" of the London Co.'s undertaking in Westminster?—in his opinion, the words must be taken to mean just what they did in the Act of 1908, under which the agreement was made, and which it purported to put into practice. The company, like an individual, were bound to manage and work the business with reasonable care and skill and with an honest regard to the interest of the parties entrusting them with it. He had no doubt that it was in this sense that the words were used in the permissive section of the Act of 1908, and this must prevail in agreements made to carry into effect the powers so granted. The power to allow another company to manage and work an undertaking which was rendering services to the public did not mean that it might be put into hostile hands to be strangled. If, therefore, the language of other parts of the agreement were such as to compel their Lordships to give to these words the meaning contended for by the respondents, a serious question would arise as to whether the agreement was not self-contradictory or in the alternative was not *ultra vires*. But he could see nothing in the language of the agreement which gave rise to difficulties of that sort. His Lordship then examined the arguments of the defendants on this head. They claimed, *inter alia*, that the London Co. had no further interest in the undertaking—its sole asset was the annual payment of £21,735 and the guarantee as to the purchase price, and that, therefore, it was the intention of the parties that the defendants should do what they liked with the undertaking, avoiding, of course, violation of the statutes. But it could not be assumed that if fairly worked and managed by the defendants, the plaintiffs' undertaking might not fetch a higher sum than £100,000, and he did not think that the defendants' contention was sound, that the arrangement meant that, on their undertaking to pay £21,735 per annum and to guarantee a purchase price of £100,000, they obtained the privilege of getting rid of a competitor so far and so soon as they could do so without violating statutory obligations. That was not, in his opinion, a fair exercise of the permission to allow companies to associate or give mutual assistance in the management and working of their undertakings, or a fair interpretation of the language of the agreement itself.

The second question was whether the Westminster Co., as managing and working the London Co.'s undertaking, was entitled to refuse to give a supply of alternating current to owners and occupiers applying to that company for it, and entitled to a supply of electric energy from that company. He thought the one simple and decisive answer to that question was this. The London Co. was bound to give to such owner or occupier a supply of alternating current, because it could give no other. It had never taken the necessary steps to qualify itself in the Westminster area for distributing continuous current, either by laying the requisite mains or erecting the stipulated generating, or, rather, transforming plant, *i.e.*, the motor-generators. It was abundantly clear that an electric lighting corporation could only give its statutory supply from its own mains. The order was full of provisions as to the responsibility of the company for the conditions of its mains, the preparation of maps of those mains, which were to be open to the public for inspection, and so forth. All these precautions were for the benefit of owners and occupiers who were entitled to a supply from the company. The whole of these provisions would be evaded if the company could refuse to connect a would-be consumer with its own mains and force him to take his supply from some other source. It followed, therefore, that the London Co. had no power to give a statutory supply of continuous current in the Westminster area, because it had laid no mains for the purpose, and, indeed, had done nothing to enable it to make use of the additional system of supply which it used in some parts of its area south of the Thames. His Lordship, having referred to what he characterised as the "curious process of reasoning" by which the defendants seemed to have arrived at the conclusion that the London Co. might distribute continuous current to the public in Westminster—namely, that, as managers of the London Co.'s undertaking, they were entitled, as against the public, to call the mains of the Westminster Co. London Co.'s mains, which he considered wholly unsupported by anything in the agreement, said:—

It follows, therefore, that in both of these, their main contentions, the Westminster Co. have been in the wrong. It remains to consider what should be the relief given by this House in the circumstances of this case. It is not necessary to grant any injunction, as there is no reason to think that the defendants will fail to act in accordance with their obligations when these have been duly declared. I should suggest the following declarations:—

1. That it may be declared that the defendants in managing and working the plaintiffs' undertaking in the Westminster area are bound to do the same with reasonable care and skill, and with due regard to the interests of the London Co. therein.

2. That it may be declared that according to the true construction of the said agreement of May 4th, 1910, the defendants are as between themselves and the plaintiffs bound, if required so to do by the plaintiffs, to supply electric energy by means of the plaintiffs' alternating current to any consumer, or proposing consumer, in the Westminster area who applies to the plaintiffs for a supply of electric energy, and is entitled to receive from them a supply of the same, and whose application is duly forwarded by the plaintiffs to the defendants for execution, and to do, and permit to be done, all acts and things necessary for furnishing such customer with the plaintiffs' alternating current.

The defendants should pay the costs of the actions and the appeals.

Harris *v.* Hulton

In the City of London Court, on Tuesday, before his Honour Judge Lumley Smith, K.C., a claim was made by Mr. Corbin Harris, the liquidator of the Oro Light and General Supply Co., Ltd., 36, Cock Lane, Snow Hill, E.C., to recover £2 17s. 4d. against Messrs. R. P. Hulton & Co., electrical engineers, 109, Great Eastern Street, E.C., for electric lamps supplied last year. The claim was admitted, but the defendants raised a set off for £3 18s. 6d., alleging that the lamps were useless.

Defendants' solicitor stated that the defendants required 72 105-volt electric lamps for use at the Picture Palace, Windsor. The defendants had to return them, because the caps were loose, and defendants had to get others at a cost of the sum now counterclaimed for.

Defendants' manager said the plaster that held the cap became loose, and they were useless.

Mr. Harris, the plaintiff, said he was formerly the chairman of the Oro Light Co. He received the order in question. Every lamp was tested before it was sent out and found to be quite satisfactory. That was the only complaint which they had had. If the lamps were put in the damp, such as outside a picture palace, they would be injured, because the cap was fixed on with plaster of paris. If the lamps were to be put outside they ought to be put in a proper casement. That was usual; otherwise they had to be fixed on with gutta-percha. That was the only way of resisting the wet. The lamps in question went wrong because they were put outside the picture palace. They might have been spoilt by too strong a voltage being used.

Judge Lumley Smith: My voltage is 200. I expect the lamps to stand that.

Witness: If you put a 150-volt lamp on to your 200 voltage it will soon smash the lamp.

Judge Lumley Smith thought the plaintiffs' lamps ought to have lasted some time without going to pieces as they had done. Plaintiff said it must be due to exposure. He would have thought that electric lamps ought to go outside as well as inside. He did not see why they should not if properly made. He was disposed to think the defendants had made out their case. They could not

recover anything in that case, but the plaintiffs could not recover any of their claim. Defendants would set off the amount of the plaintiffs' claim, and defendants could claim the rest in the plaintiff company's liquidation. It was not a case for costs.

Post Office Telephone Grievances.

The Postmaster-General, Mr. Herbert Samuel, sued Mr. W. J. Macmanus, 26, Agate Road, Hammersmith, on Tuesday, in the City of London Court, for £2 6s., the return of telephone apparatus and telephone calls due.

Mr. Allsopp, plaintiff's solicitor, said that the defendant entered into an agreement to have the telephone service in September, 1910. The period expired and he would not return the apparatus without the Court's order.

Defendant said he had the telephone on January 18th, 1912, and from the moment of the installation there had been nothing but trouble. No proper instrument and no proper service had ever been given him. The workmen were never out of the house. There had been one incessant series of complaints. The telephone was absolutely necessary to his business, and, bad as it was, he had to put up with it, as it was no earthly use to argue with the Post Office Department. Then he was sent a fresh agreement for the old apparatus, and he objected. He had always been prepared to pay his rent. The agreement was most inequitable.

Judge Lumley Smith said he had been expecting it to be taken to the Court of Appeal, but no one had done it yet.

Defendant added that the service made his place more like a comic scene in a pantomime than a business house. On the last day of the service it took him 32 minutes to get through to the exchange.

Judge Lumley Smith said the defendant only owed 2s 8d. for fees. He would have to pay that, and £1 16s. 5d. in respect of the apparatus. The latter money would not be payable if he gave up the apparatus. Judgment accordingly.

Compensation Case.

At the Rochdale County Court, on Friday, Mr. R. D. Mattley, representing Mrs. Eliza Brierley, 103, Peel Street, Rochdale, applied to Deputy Judge Leresche, for an order directing Messrs. R. & T. Howarth, contractors, of Royds Street, to pay £275—an agreed sum—as compensation on account of the death of her husband. Mr. Mattley said the husband was employed by Mr. Geo. F. Endersby, a contractor, to whom Messrs. R. & T. Howarth had sublet certain work in connection with an extension at the Rochdale Corporation Electricity Works. Whilst working there on January 3rd, Brierley, who was a journeyman joiner, fell from scaffolding and died the same day from the effects of the injuries he received. The respondents had served notices for the purpose of being indemnified by Mr. Endersby. Mrs. Brierley, however, was entitled to an award.

The Judge awarded Mrs. Brierley £275, and, on the application of Mr. Mattley, he granted her an immediate payment of £25, and made an order for her to receive the remainder at the rate of £3 a month.

Messrs. R. & T. Howarth then claimed to be indemnified by Mr. Endersby for the amount they have to pay Mrs. Brierley. Dr. Atkinson (instructed by Mr. C. B. Hudson) represented Messrs. R. & T. Howarth, and Mr. Acton (instructed by Mr. J. Bright Clegg) appeared for Mr. Endersby.

At the invitation of the Judge, counsel went into his private room. On returning into court, his Honour said the case could not be finished that day, and he did not think it should be commenced and left for another judge—who might be sitting at the next court—to finish. The adjourning of the case might also enable the parties to come to some arrangement.

All engaged in the case agreed to it being adjourned to May 23rd. It was accordingly adjourned to that date.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Automatic Earthing Device.

A new pattern of disk type earthing device, made by Messrs. A. Reyrolle & Co., Ltd., is illustrated herewith. It consists of an isolating switch combined with a paper disk earthing device. The latter part is of special interest at the moment, particularly in view of the discussion which followed the paper recently read before the Institution of Electrical Engineers by Mr. J. S. Peck.

It consists of a paper-insulating disk A, fig 1, which can be made of any thickness or material according to the voltage at which it is required to spark over. The terminals T are enclosed in an insulated box B, and dropped into a carrier C. The carrier is in the form of a change-over switch, so arranged that when the disk is temporarily removed a direct earth connection takes its place. It is, therefore, possible to have three positions:—

1. Isolating switch open, in which position the neutral point is insulated.

2. The isolating switch closed, insulating disk in place (fig. 2). In this position the neutral point is again insulated, but in the event of a disturbance on the system occurring, which would cause potential difference between the neutral point and earth, the disk would be pierced, and the neutral point thereby automatically earthed.

3. In the third position, the neutral point is earthed direct, and in this position the disk box can be conveniently removed for inspection or replacement (fig. 1).

The principal demand for this arrangement is from those systems where the neutral point is earthed at the power station and, in accordance with the Board of Trade regulations, it must *not* be permanently earthed at any other part of the system.

It may so happen that main switches are open, and certain parts of the system become isolated from the section where the neutral point is earthed. At the same time, the sections whose neutrals are thereby insulated remain in commission, possibly on account of

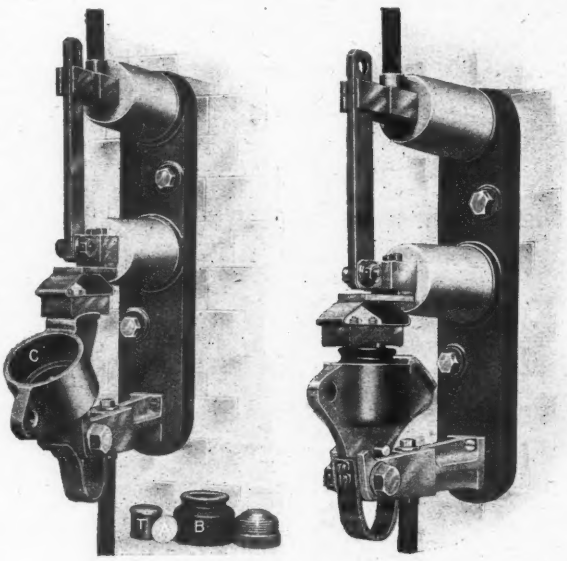


Fig. 1. Fig. 2.

Reyrolle Automatic Earthing Device.

step-up transformers, or because they are connected to another power station. When such a contingency occurs, the use of the above earthing device at the neutral point of the static transformers provides for automatic earthing, and, in the event of an accident, for instance, an earth on one phase occurring, the device would ensure the proper operation of the main switches, and so avoid the risks which might be attendant upon a line conductor being accidentally earthed on what would be, but for the use of the earthing device, an insulated system.

As a safety device, the arrangement has a further use in a modified form on the secondary of step-down static transformers, in those cases where it is necessary to provide some means for isolating the static transformer in the event of a failure of the transformer occurring, which would tend to raise the potential of the secondary, for instance, a contact between primary and secondary winding.

Focusing Reflector Lamp.

The object of the British Thomson-Houston Co.'s new concentrated-filament "Mazda" lamp is to get a filament approximating as closely as possible to the theoretical point source of light. The

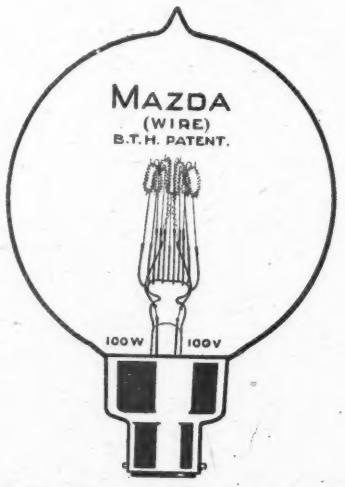


Fig. 3.—B.T.H. "Mazda" Lamp with Concentrated Filament

lamp is made in three sizes—50 watts, 100 watts and 200 watts—and in voltages ranging from 12 to 200. The filament is made of drawn tungsten wire wound in a very narrow spiral, which is formed into a series of loops bunched closely together. By this means it is possible to get a very high candle-power filament in a small compass. For example, the 100-volt 100-watt lamp (giving approximately 100 C.P.) has a filament which could be contained in a cubical space measuring $\frac{1}{2}$ in. × $\frac{5}{8}$ in. × $\frac{3}{8}$ in. (see fig. 3). This new "Mazda" lamp has been designed for use with parabolic reflectors in motor headlights and searchlights, and in optical lanterns, photographic enlarging lanterns and small cinematograph projectors. For these purposes this lamp has all the advantages of the ordinary incandescent electric lamp in regard to cleanliness and safety, and in addition gives the concentrated light source necessary for accurate reflection with parabolic reflectors, or projection by means of lenses and condensers.

The Aston Ball Body.

We illustrate in fig. 4 the "Aston" three-light adjustable ball body, which is supplied by Messrs. Veritys, Ltd., London, for use with 3¼-in. lip Holophane reflector bowls and open glassware. It is claimed that this device enables the glass reflector to be taken off for cleaning without unwiring and removing the body; and that

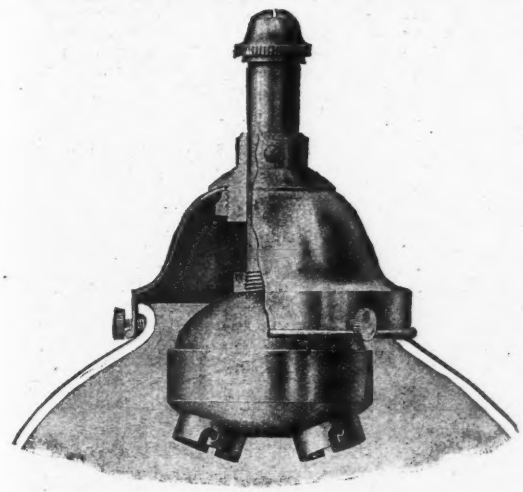


Fig. 4.—Aston Ball Fitting.

it allows the lamps to be placed in their correct position inside the bowl by means of the set screws (on collar), which hold the adjusting tube as required. The body is supplied wired for two circuits, one and two lights, ready for fixing, and it can be equally well used for large Holophane bowls or open shades having a 3¼-in. lip.

Recording Blast-Furnace Charges.

Ironworks managers will not need to be told that the sooner the operation of charging blast furnaces is over, the better. Obviously the longer the furnace bell is lowered, the longer does gas escape which can be utilised advantageously, and

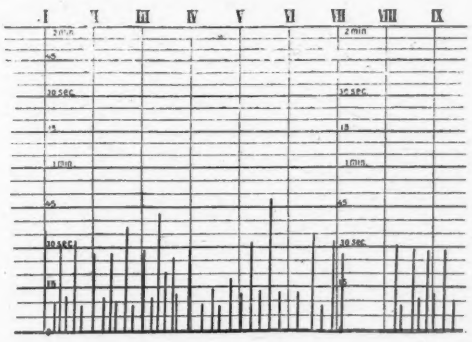


Fig. 5.—Furnace Charging Chart.

hence it becomes of importance to have some check on the periods of charging, not only as regards the time when the charge took place, but also the actual time consumed in completing the charge. In order to meet these requirements, a very ingenious and yet simple device has been developed by Messrs. Works Control, Ltd., of St. Margarets-on-Thames. This consists of a recording drum, on which is placed a time chart such as is shown in fig. 5. On this time chart the pen moves uniformly upwards at a fairly rapid rate so long as the electrically-controlled mechanism of the recorder allows it to do so. When current is shut off from the recording mechanism, the pen drops out of contact with the chart, and falls back again to its lowermost or zero position. On examining the chart which is shown, it will be seen that the pen marks intersecting horizontal lines are not strictly vertical. This is caused by the fact that while during a certain interval the pen is moving upward at a fairly rapid rate, the time chart is also being moved forward at a slow rate, so that the lines become diagonal. Now, supposing that the vertical distances are ruled to a very open spacing, so that the total height of the paper corresponds to, say, a two-minute vertical travel of the pen, while the horizontal travel of the drum chart is made a 24-hour circuit, it will be seen that on the same chart can be recorded the times at which the bell was lowered by examining the horizontal distances, while by examining the vertical distances one can obtain the interval in fractions of a minute that the bell was kept lowered.

The electrical mechanism in the recorder is operated by the closing of a circuit having switch contacts, which are closed when the furnace bell is lowered. The current necessary for operating the instrument may be supplied by a small battery or the supply used for lighting the plant. The actual size of the chart which is shown in the illustration is 5½ in. high and 7¼ in. long, so that accurate measurements can be obtained.

BUSINESS NOTES.

Condensing Plant Contracts.—The following is a list of some recent orders received by the Mirrlees-Watson Co., Ltd., of Glasgow:—

Surface condensing plant with Mirrlees-Leblanc rotary air pumps.—Two sets for the County of London Electric Supply Co., per the British Thomson-Houston Co., Ltd. Two sets for auxiliary machinery for H.M.S. *Queen Elizabeth*, per Peter Brotherhood, Ltd. One set for Aberdeen Corporation, per Mr. G. Wuthrich. One set for Sheepbridge Coal and Iron Co., per the British Thomson-Houston Co., Ltd. One set for Fleetwood U.D.C., per Messrs. Jas. Howden & Co., Ltd.

Surface Condensing plant with Mirrlees-Edwards air pumps.—One set for the Lancashire Electric Power Co., and one set for New Zealand, per Messrs. Hendry Bros.

Mirrlees multi-jet condensing plant.—Two sets for the Summerlee Iron Co., and one set for the Cambrian Collieries, per the A.E.G. Electric Co. One set for Flemington Coal Co., and one set for Tinsley Park Colliery, per Messrs. Greenwood & Batley, Ltd. One set for Moorbrook Mills, per the British Thomson-Houston Co., Ltd. One set for Bargoed Colliery, and one set for Glasgow Iron and Steel Co., per Messrs. Fraser & Chalmers, Ltd. One set for the Weardale Steel, Coal and Coke Co. (repeat order). Two sets for the Londonderry Collieries, Ltd., per Mr. Wm. C. Mountain. One set for the Powell-Duffryn Steam Coal Co., Ltd. One set for J. Whiteley & Sons, Ltd., per Messrs. Daniel Adamson & Co. One set for the Glengarnock Iron and Steel Co., per Messrs. Jas. Howden & Co.

Barometric Condensing Plant with Mirrlees-Leblanc Rotary Air Pumps.—One set for Birtley Colliery, per Messrs. C. A. Parsons & Co. One set for the Powell-Duffryn Steam Coal Co.

Mirrlees-Leblanc Simple Jet.—One set for the Denton Colliery Co., Ltd.

Low Level Jet Plant.—Two sets for the Sheepbridge Coal and Iron Co. and one set for Dinnington Main Colliery, per the British Thomson-Houston Co., Ltd.

Barometric Plants with Reciprocating Dry Air Pumps.—Four sets for Peru and one set for the Argentine.

The above represents a total steam duty of over 1,000,000 lb. per hour.

Hydro-Electric Contracts.—Messrs. Boving & Co.'s recent contracts include 17 km. of welded-steel pipe for the 1912 extensions of the Victoria Falls and Transvaal Power Co. The line consists of pipes of 27½, 22 and 16 in. diameter, the pressure being 100 lb. per sq. in., while the temperature of the compressed-air is as high as 80° C. They are also supplying a further 11,000 ft. of 15-in. pipe for the Rand Water Board. Other orders include two water turbines of 225 H.P. for the Kawasugawa Hydro-Electric Co., of Japan, and one of 70 H.P. for the Wheal Jewell & Marytavey Mines (Cornwall). Orders for pumps include one 3,000-gallons Victoria pump for Messrs. Hulett, Durban; two 8,950-G.P.M. pumps for Messrs. Willans & Robinson, for Sydney; one 100-G.P.M. pump for the Soudanese Irrigation Department; eight Victoria pumps of various capacities for the Papéteries de Rethel, Ardennes, France, to which company the firm are also supplying a complete 110-in. paper-making plant.

Catalogues and Lists.—The Eastern Electric Co., Ltd., 11, Queen Victoria Street, London, E.C.—Catalogue, consisting of a number of lists containing illustrations and prices of a variety of electrical accessories. These include switches, lampholders, ceiling roses, cut-outs, fuseboards, wall plugs, opal shades, wood blocks and casings, wires and cables, bells and bell accessories, and ironclad switches.

The Electrical Co., Ltd., London, W.C.—Stock list of A.C. and C.C. motors, and other machines.

Bankruptcy Proceedings.—Samuel Smith (trading as Smith & Sons), 22A, 24 and 26, Victoria Square, Widnes, Lancs., electrical engineer, &c.—The public examination of the above-named debtor was held at the Court House, Government Buildings, Victoria Street, Liverpool, last Monday, when the liabilities were put at £270, and there was an estimated surplus of £648. It appeared that the debtor started trading at Widnes about 23 years ago, and until recently the business had proved very successful. Two of his sons had been in the business, but he had declined to make them partners while they were under 21 years of age. Last August debtor consulted a solicitor who advised him to execute a deed of assignment for the benefit of his creditors. He agreed to this course, and ultimately two trustees were appointed

under the deed, the business in the meantime, pending sale as a going concern, being carried on by him at a weekly salary of £2. His liabilities at that time were about £461, and he estimated that his assets were worth £1,550. Creditors to the extent of £114 odd did not assent to the deed within the time specified, and were now scheduled as unsecured creditors for that amount. Since the deed liabilities had been incurred amounting to £156 odd. Debtor was questioned by the Official Receiver as to his estimate of the value of his assets, and was reminded that the trustees had been put to considerable expense in resisting a claim made in the Chancery Court by his sons, who asserted that they were partners in the business. The Official Receiver further stated that he understood that the debts were understated at the time of the assignment. Debtor maintained that if the estate were properly dealt with there should be a large surplus for him. After further questions had been asked the examination was ordered to stand adjourned.

E. J. Crosier (Crosier, Stephens & Co.), engineer and merchant, Newcastle-on-Tyne).—April 26th is the last day for the receipt of proofs for dividend. Trustee: Mr. J. A. Gardner, 145, Pilgrim Street, Newcastle-on-Tyne.

Electric Clocks.—We are informed that the great house of Whiteley's, Westbourne Grove, is to be equipped throughout with a service of uniform and accurate time by the Synchronome Co., Ltd., of 32 and 34, Clerkenwell Road, E.C. The installation will comprise a very large number of their "one-wheel" electrical impulse dials, and will include handsome turret clocks on the galleries under the domes. The same company have also in hand their fourth extension of the time circuit in Waterloo Station. Railway companies have a reputation for caution and conservatism, but from a list before us of "Synchronome" installations in railway stations in all parts of the world, it appears that this system of time-keeping is appreciated by them. The Buenos Ayres and Great Southern Railway is among the latest to go in for this system.

Willans & Robinson, Ltd.—The scheme of capital re-arrangement recently proposed to and accepted by the shareholders of this company, was duly confirmed by the High Court last week. The company has always been so closely identified with the electrical industry, and has carried out so much excellent work, that we feel our readers will join with us in the hope that its trading may continue for the benefit of the industry at large, and that the company itself may now enter upon a renewed stage of prosperity. It is interesting to learn that the business now in hand, especially in steam turbines and Diesel engines, shows a larger volume than for some time past.

Dissolutions and Liquidations.—Meldrum Bros., Ltd., Timperley.—A second dividend of 3s. in the £ is payable April 7th at the office of Mr. Theodore Gregory, 3, York Street, Manchester.

S. T. Robbins & Co., automobile, electrical and general engineers, 19, Port Street, Evesham.—Messrs. Stanley T. Robbins and H. S. Hunt have dissolved partnership. Mr. Hunt will attend to debts.

Messrs. Simpson, Scott & Co., electrical contractors, Cape Town, have dissolved partnership. Mr. Simpson is carrying on business as district agent for Messrs. Orenstein and Arthur Koppel, Ltd, and Mr. Scott is joining the local agency of the A.E.G. Co. as technical adviser.

For Sale.—The Darlington Corporation has for disposal a 35-kw. steam dynamo. See our advertisement pages in this issue.

Messrs. Wheatley Kirk, Price & Co. will offer for sale by auction on April 30th the plant, machinery, stock, &c., at Falcon Works, Bedford Street, Greengate, Salford, under instructions from Mr. T. R. H. Tetley, who is discontinuing manufacturing. See our advertisement pages to-day.

Trade Announcements.—The Electric Battery Co. has removed to more extensive premises at 62, Eagle Street, High Holborn, W.C. (Telephone No. "Holborn 1080,"), where they have a floor area of over 6,000 sq. ft., which will be equipped with modern plant for the manufacture of E.B.C. (patent) dynamos for car lighting, accumulators, &c.

Messrs. Powley Bros., electric lighting engineers, &c., of 32, Park Road, Kingston-on-Thames, have opened additional premises at 81, Ditton Road, Surbiton.

Mr. Donald Smeaton Munro, M.I.E.E., acquired, in March, 1912, that section of the electrical business of Anderson & Munro, which was formerly worked from Edinburgh. To avoid confusion, this Edinburgh section is now carried on by, and under the name of, Donald Smeaton Munro, 11, Randolph Place, Edinburgh, and all communications should be so addressed.

LIGHTING and POWER NOTES.

Accrington.—The refusal of the Rishton District Council to allow the Accrington Corporation to supply electrical energy to Messrs. Peebles & Sons' Works, Rishton, has led the Accrington Electricity Committee to the decision to apply to the B. of T. for an Order permitting it to give the supply desired. It has also been decided to apply to the L.G.B. for sanction to borrow £2,000, the estimated cost of laying and supplying the necessary mains and transforming plant in connection with the supply.

It is proposed to give domestic consumers the option of an assessment tariff—viz., a fixed rental of 12½ per cent. per annum on the net rateable value, to be apportioned over the various quarters of the year as follows:—First quarter, two-sixths; second, one-sixth; third, one-sixth; fourth, two-sixths, together with a charge of ½d. per unit, with a discount of 5 per cent. from all accounts paid on or before a specified date. It has been decided to adopt a charge for all purposes other than for power from April 1st of 4d. per unit, subject to discounts on accounts paid before a specified date varying from 10 to 25 per cent., according to consumption.

Atherton.—The U.D.C. has confirmed a proposal of the Electricity Committee to apply to the L.G.B. for sanction to borrow £5,500 to meet the cost of a new transformer station, feeder cable, &c.

Australia.—The report of the Electric Supply Committee of the Melbourne City Council for the year 1912, according to the *Australian Mining Standard*, shows that in spite of (perhaps because of) reductions in the price at which current is supplied to consumers, and in spite of large new expenditure on plant, there is still a credit to profit and loss account, though of about a third less than for 1911. The gross revenue for 1912 was £130,276, and the working expenses amounted to £65,130; the gross profit, therefore, was £65,146. Charged against this was interest on capital, commission and exchange, £19,357; sinking fund, £5,615; depreciation and renewals, £23,458; on account of loans, £844, making a total of £49,274, and leaving a net profit for the year of £15,871. The revenue from the sale of current for private lighting purposes increased from £59,679 to £68,936, and the revenue from heating and power by nearly £8,000. In allocating the amount to be set to the various accounts, a sum of £8,750 was contributed to the town fund, and £5,615 to the sinking fund, making that fund now £99,184. The depreciation and renewals account amounts now to £163,514; during the current year this fund will be drawn upon extensively for the cost of plant which is being scrapped to make way for new plant of a larger capacity and greater efficiency. The net profit in 1911 was £22,000.

It is stated that the Commonwealth Government has decided to equip the Federal Woollen Mills at Geelong, Vic., with a complete electric power plant.

Banbridge (Co. Down).—Mr. G. B. Deane, B. of T., has held an inquiry into the application of the Urban Council for a prov. order. Mr. Gordon explained the scheme, which would cost about £3,300. The borrowing powers of the Council ran up to nearly £30,000, and the gross valuation of the town was £14,456. Mr. Pleasance, of the firm of Messrs. Woodside & Co., Belfast, having given evidence of the projected scheme, the inquiry was adjourned.

Bath.—The L.G.B. has sanctioned the borrowing of £1,789 for district mains, services and transformer pillars in the Weston area; £2,250 for prospective expenditure on mains; £2,250 for prospective expenditure on services; and £5,000 for prospective expenditure on transformers—each for a period of 15 years, and has authorised the allocation of the sum of £1,210 out of the Diesel engine loan, which is not required for the purpose, to make up the balance required for the mains, &c., in the Weston area.

Bootle.—The T.C., on the 2nd inst., approved of the scheme recommended by the Electric Power and Lighting Committee, for extending the electricity mains, at an estimated cost of £4,375. It was decided to apply to the L.G.B., for sanction to borrow a sum of £3,750 for defraying the cost of a portion of the scheme, and the remainder will be defrayed out of loans already sanctioned.

Bradford.—The Chamber of Trade is in negotiation with the Corporation Electricity Department, with a view to the possibility of reductions in electricity charges, and the payment of discount by taking an amount off accounts instead of the Corporation giving free lamps. The provision of these free lamps, in lieu of discount, is stated to be an injustice to the local electrical contractors. It is also stated that last year the Corporation placed an order for a quarter of a million such lamps.

Braintree.—The U.D.C. has decided to obtain expert advice on the question of lighting the town by electricity.

Brighton.—A fairly large electrical cooking installation has now been running for a few weeks at Messrs. Staffords, in Western Road. This is used for preparing meals for a staff of some 70 hands, and consists of a Jackson range, with eight heating plates and two large ovens, in which several big joints can be cooked at the same time. The control board is mounted behind, and fitted with indicating lamps showing exactly what heater is in use. We gather that experience with the range has been highly satisfactory, its cleanliness, efficiency, and the improved cooking being much appreciated.

Canada.—The municipal electrical department of Ottawa last year made a profit of $35,000, as shown by the statement presented by the Electric Commission. Since the plant was taken over in 1907, the profits have totalled $132,652.28—this after reducing the price of electric current in the city to one-half of the former rates.

Colwyn Bay.—An inquiry has been held by the L.G.B. relative to the application of the U.D.C. for sanction to borrow, among other sums, £5,300 for additional generating plant at the electricity works, to meet the growing supply. It was pointed out that the load on the works last season came up to the maximum capacity of the machinery installed, so that the increase was essential for the safety of the supply. No opposition was raised to the proposals.

Dartford.—The U.D.C. has instructed the electrical engineer to proceed with the preparation of plans and specifications for a H.T. generating set, as the demand is likely to soon necessitate the generation of H.T. current direct. The Council has declined to entertain a suggestion from consumers at Crayford that the supply to that district should be treated as a whole, and that the charges for power should be based on the united demands of all the works connected to the new main.

Doncaster.—The T.C. has adopted a new scale of charges for electricity for power and domestic purposes, by which 1½d. per unit will be charged for the first 500 units per annum, 1¼d. per unit for the second 500, 1¼d. per unit for the third 500, and 1d. per unit for the fourth 500.

It was reported that the Electricity Committee had finished the past financial year with a surplus of £1,055, although some of the charges had been considerably lowered. For the extension of electricity mains and plant an expenditure of £13,206 is estimated to be necessary in the coming year.

Dewsbury.—At the T.C. meeting, last week, a long discussion ensued upon the subject of the Corporation's municipal trading undertakings, the rates, and the financial position generally. Sir Mark Oldroyd said that the development of the tramways, if carried out, might cost another 10d. rate. He complained of the extensive appropriation trading profits for relief of rates, maintaining that the purpose of these undertakings was the convenience of the public. Mr. T. Myers criticised the action of the Council in taking £500 from the electricity department for relief of rates when it had just borrowed £8,000 for works extensions.

Dover.—The T.C. has received from the L.G.B. sanction to a loan of £300 on account of transformers.

Dromore (Co. Down).—A B. of T. inquiry was held on the 5th inst. into an application on behalf of the Urban Council and a number of ratepayers to provide electricity for lighting and power purposes in that town. The application was opposed by some ratepayers and the local gas company. Evidence was given of the finances of the town, by which it appeared that it had borrowing powers up to £10,000, and its debts and liabilities were under £2,000. Nine of the 10 members of the Council were in favour of the scheme. Two schemes had been submitted, one costing £3,998 and the other £3,400. Mr. H. V. Pegg, consulting engineer, of Belfast, gave the details of the schemes, after which the inquiry adjourned.

East Ham.—At the last meeting of the T.C., a letter was read from Woolwich B.C., stating that the limited consent given to it for supplying current to the L.C.C. pumping station at North Woolwich only, would be quite useless, as it would be unable to incur the expense unless allowed to supply properties on the route of the main, and stating that it would be prepared to pay a percentage upon the total revenue received from the supply if allowed to do this. The T.C. is agreeing to the suggestions put forward, subject to the payment of 5 per cent. upon the total revenue received from the supply.

Gillingham (Kent).—With reference to the Corporation's contract with the Augsberg-Nurnberg Co. for the installation of a new Diesel engine at the electricity works, the T.C. has entered into a supplemental agreement with the company to enable the British Westinghouse Co. to at once proceed with the construction of the alternator, the cost of which will be £1,019.

Grasmere.—The question of electric lighting in the Council's area has been introduced by a company. The Council is giving preliminary support to the scheme, which it is proposed shall include street lighting.

Halifax.—A L.G.B. inquiry into an application by the Corporation to borrow £18,180 for the purchase of plant at the electricity works, and for extensions of the electric mains, has been held. Mr. Haley, chairman of the local Ratepayers' Association, opposed the application.

Leeds.—At a recent meeting of the T.C., on the presentation of the Electricity Committee's minutes, Mr. D. B. Foster moved an amendment to refer back a recommendation to defer further consideration of the question of instituting a scheme of motor hiring in order to give time for trial of a scheme submitted by Mr. H. S. Ingleby. He urged that it would be more to the interests of the manufacturers of the city if steps were taken to get into touch with other motor manufacturers, than to consider the scheme of Mr. Ingleby, who had written stating the terms upon which nine Leeds firms were prepared to supply motors on hire or hire-purchase. Mr. Hugh Lupton pointed out that by the terms of the Committee's recommendation the Council would not be in any way pledged to the firms mentioned. Mr. R. Armitage said the letter contained a suggestion that officials of the Corporation canvassed the city solely, or to a large extent, with a view to pushing the sale of certain makes of motors to the prejudice of other makes equally good. He thought in the interest of the officials these charges ought to be investigated. Alderman Tetley intimated his willingness, on behalf of the Committee, to insist on the withdrawal of these passages in the letter. Mr. Hugh Lupton said the sub-Committee concerned would undertake to investigate the matter raised with regard to the officials. The amendment was carried.

The proposed reduction in charges, more particularly to large power consumers, referred to last week, was also agreed to; it is estimated that power users will benefit to the extent of £4,000 per annum under the new rates.

Leyton.—The U.D.C. has applied to the L.G.B. for a loan of £6,456 for mains, feeders, &c.

Liverpool.—In his annual report which has just been issued, the city lighting engineer states that a great improvement has been effected during the year in the centre of the city by the fixing of 70 flame arc lamps in lieu of open type and metallic-filament cluster lamps, the light being increased thereby at least fourfold. An extension of electric lighting by metallic-filament lamps has also been carried out during the year on the Edge Lane tramway route with 50 and 100-C.P. lamps. At the end of the year there were in use 921 electric lamps, 192 arc, and 729 incandescent metallic-filament lamps.

London.—Battersea.—With reference to the motion for an injunction taken by the Council to restrain the County of London Electric Supply Co. from laying mains in the borough, the the Council has received a letter from the solicitor of the company forwarding copy of notice of appeal and copy of a letter which had been addressed to the B. of T. on the company's proposal. The Council decided to ask the Board to postpone taking action in the matter until the application of the Council to the High Court had been dealt with.

Woolwich.—In order to be able to give a supply of current to the new hostels in course of erection at Eltham for the L.C.C., the Borough Council has decided to borrow £1,448, the estimated cost of providing transformers and switchgear at the High Street substation; also for the provision of a duplicate main to New Eltham, which will provide for a general supply also being given, if required.

St. Marylebone.—The Electric Supply Committee has considered a letter inviting the Council to join in a general conference to consider the decision of the L.C.C. to again revise the maximum periods which it will sanction for the repayment of electricity loans in respect of buildings, mains and machinery, and with the object of representing to the L.C.C. the advisability of reconsidering and amending such decision. The Committee did not think that any useful purpose would be served by the Council joining the proposed conference, and recommended accordingly.

Lossiemouth.—The B. of T. has approved of the order for the electric lighting of the town.

Macclesfield.—The New Electricity Co. of Macclesfield, Ltd., has informed the T.C. that the response to the invitation to various persons to take shares in the concern, has not been such as to justify the company making a start on the proposed electricity works. The company was formed about two years ago, and obtained a prov. order for electric supply, and this expires by effluxion of time on August 11th next. A new syndicate has come forward and taken over the company's powers and responsibilities, and has taken a disused dyeworks in George Street as a site for a generating station.

Manchester.—Mr. S. L. Pearce, the chief engineer of the electricity department, and Mr. J. G. Newbigging, engineer of the gas department, were recently instructed to consider the question of street lighting, and they have prepared a report which has been approved by the Lighting Committee of the Corporation—a Committee which consists of members of the Gas, Electricity and Finance Committees. The report states that the two engineers are agreed on certain recommendations. One is that a further extension on a moderately large scale of the lighting of the principal thoroughfares in the city be made with high-pressure gas, and electric arc or metal-filament lamps. The total length of the streets to be lighted by the first-named system is 13,500 yards, and that of the streets to be lighted by electricity is 11,835 yards. In arriving at the allocation of streets, the engineers have had regard to the thoroughfares in which special arc lighting cables are already laid, and the suitability or unsuitability of the streets scheduled for centre suspended lighting or side lighting, it being their opinion that, broadly speaking, one set of streets are best dealt with by means of electricity, whilst others are more suitable for the high-pressure gas system. They have not attempted to deal with secondary thoroughfares or with the lighting of courts and passages, and they recommend that this be deferred pending the result of the present proposal.

Mexborough.—A L.G.B. inquiry has been held in connection with the application to borrow £11,500 for extensions of the electricity undertaking. Mr. J. Senior (electrical engineer) stated that the amount was made up as follows:—Turbo-generator, £4,200; buildings, £3,200; boiler foundation, £800; water cooling tower, £800; pipe work, £400; balancer-booster, £330; three years' prospective services, £300; three years' public lighting, £300; contingencies, £170; builder's tender in excess of estimate, £750; and travelling crane, £250. There was no opposition to the application, and the inquiry was closed.

Newport (Mon.).—We understand that the recommendations of Mr. A. Nichols Moore, the borough electrical engineer, for extending the electricity plant, have been unanimously adopted. It is intended to install a 2,500-KW. turbo-alternator, with condensing plant, and a 600-KW. D.C. generator, with switchgear.

The engineer's proposals for lowering the single-phase frequency were also approved, but will not be carried out for another year.

New Zealand.—On February 20th, a poll of the Christchurch ratepayers resulted in a vote of 2,874 for, and 492 against, the proposal of the City Council, to raise a loan of £120,000 for equipment in connection with the utilisation of electric power to be supplied in bulk from the hydro-electric installation now being erected at Lake Coleridge. The amount is to be expended

in :—Sub-stations and plant ; transforming plant and buildings ; mains and services ; meters ; poles, lamps, &c., for street lighting. The Mayor congratulated the ratepayers on the magnificent support given to the proposal. The Wanganni borough is about to extend the tramways, the amount involved being about £9,000.

At Wellington, the engineer has been requested to report on the advisability of combining the lighting and tramways stations. The lighting supply is rapidly increasing, and it is anticipated that additional generating plant must be purchased at no distant date ; the supply is single-phase at 80 periods transformed from 2,000 to 100 volts.

Newcastle-under-Lyme.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £20,000, being the estimated cost of certain electricity extensions.

Nuneaton.—The T.C. has resolved to replace 25 gas lamps in the town by electric lamps.

Newton-in-Makerfield (Lancs.).—The U.D.C. has had under consideration a communication from Messrs. McCorquodale and Co., asking whether there was any immediate likelihood of the Council's obtaining powers for the supply of electricity, and further stating that if there was no prospect of the order being granted, it was the company's intention to proceed with the scheme it had had before it for some considerable time, for the generation of its own electric power for driving and lighting purposes. It was resolved that the question be considered with the estimates.

Orsett (Essex).—The B. of G. has decided not to let the proposed electric lighting scheme for the workhouse drop. The L.G.B. recently intimated that the premises were too small for an installation, but the Guardians have ascertained that at Buckingham the Board of Guardians has installed a small electric plant at a cost of £187, with satisfactory results. This has been inspected by two of the Guardians from Orsett, with the result that the firm who carried out the installation—Messrs. Johnson and Phillips—have been communicated with. Consequently further steps are to be taken in the matter.

Royton.—The Oldham Corporation has applied to the District Council for power to supply the Industry Mill with electricity for power purposes. There is a strong feeling in the Royton district that the Oldham Corporation should get the necessary provisional order to supply the whole of the district.

St. Helens.—The T.C. has adopted an assessment tariff for private houses, viz., a fixed quarterly charge based on the net rateable value of the house, and ¾d. per unit for all current used for lighting, heating, cooking, and other domestic purposes.

Salford.—The T.C. has adopted a recommendation to approve the settlement of the Corporation's claim against the insurance companies for damage caused by the recent fire at the electricity station for £11,383, which covers the whole of the damage.

Scarborough.—The Corporation has under consideration the question of the purchase of the local electric supply undertaking. A special sub-committee has been appointed to carry on the negotiations. The borough engineer has been instructed to obtain the consent of the Electric Supply Co. to the examination of its plant by Mr Wyld, of Birkenhead. The borough accountant has reported as to the financial position of the Electric Supply Co., and the further consideration of the matter has been deferred.

Sevenoaks (Kent).—The U.D.C. was recently informed by Mr. Frank Reeves, acting secretary of the Sevenoaks and District Electricity Co., Ltd., that all objections to the company's application for a prov. order for electric lighting had been removed, and it was advised that no doubt the order would be granted. He added that orders for oil engines had been provisionally placed, and arrangements were being made with Messrs. Crompton & Co. to supply the electrical equipment of the generating station. It was hoped that the cables would be laid almost immediately, and that by means of a temporary plant a supply of current might be made available without waiting for the completion of the permanent generating station, which would be erected at Sundridge. The company's operations will include not only the urban district, but practically half of the rural district, and Limpsfield, Oxted, and other parishes in Surrey.

Sheffield.—The Corporation is proposing to offer domestic electricity consumers the alternative of an assessment tariff, based on a fixed charge of 10 per cent. of the annual rateable value of the premises, payable quarterly, plus ½d. per unit used, with no meter rent. Consumers in premises other than private houses using electricity throughout for lighting purposes, and who sign a minimum payment form, are to be charged ½d. per unit for heating and cooking purposes. Under the latter scheme, between 700 and 800 consumers will benefit immediately.

With a view to improving the lighting of Norfolk Street and Barkers Pool, at present lighted by gas, a trial is to be made with electricity, subject to the cost of supplying and fixing the lamps being borne in equal proportions by the electricity supply department and the Watch Committee, and to the cost of maintenance and energy not exceeding the cost for gas.

Stockport.—A carters' strike has been in progress at Stockport for several days, and there were fears at one time that the electricity supply would be seriously diminished, owing to the uncertainty of securing supplies of coal. Last Saturday, however, a fresh supply of coal was obtained, wagon loads being escorted by police from the sidings to the works.

Stockton-on-Tees.—The T.C. has arranged with the Cleveland and Durham Electric Power Co. for a supply of current between 10 p.m. and 6 a.m., or, if necessary, between 6 p.m. and 6 a.m. This will obviate the expense of installing additional plant.

Tonbridge.—The Kent County Education Committee has decided to have the electric light installed at Sussex Road Schools, Tonbridge, at a cost of £56.

Torquay.—The question of electrically illuminating the gardens immediately adjoining the new pavilion is under consideration. The engineer has been directed to report as to the general use of electric cookers ; also to obtain four sample street lighting lamps from certain firms, and to fix them for experimental purposes. The results will be compared with the 1,000-c.p. Osram lamps now in use. Current is to be supplied to flame arc lamps outside shop premises on the following scale, subject to the type of lamp and the conditions of supply being approved of by the engineer in each instance :—1,600-c.p. lamps, 1d. per lamp per hour ; 2,400 c.p., 1¼d. ; 3,300 c.p., 1½d.

Tunbridge Wells.—The E.L. Committee proposes to convert a further 50 gas lamps into electric lamps in those streets in the town in which electric cables are laid.

Watford.—The Northwood Electric Light and Power Co. having applied to the B. of T. to dispense with the consent of the R.D.C. to its extension order, the B. of T. deemed it advisable for the promoters of the Order and the objectors to attend a conference in London. This took place on April 1st.

The T.C. has decided to alter the assessment tariff from the present rate of 12½ per cent. plus 1d. per unit, to 12½ per cent. plus ¾d. per unit.

Wimbledon.—The Sub-Committee appointed to consider and deal with any questions arising in connection with the supply of electrical energy by the Council to the Fixed Price Light Co., Ltd., reports that it has instructed the borough electrical engineer to prepare and submit a report upon the fixed-price light system of supply, and the actual and probable results of the working of such system in Wimbledon and Merton, including the question of transformer losses.

York.—The electricity department has decided to reduce the price of electricity to consumers who are charged on the flat rate system, and from April 1st the charge is to be 3½d. per unit for all consumptions not exceeding 4,000 units per quarter, instead of a sliding scale of 4½d. per unit to 3½d. per unit, according to consumption. The reduction has been brought about by the increasing demand for current, and the more economical means of generation in vogue at the electricity works.

TRAMWAY and RAILWAY NOTES.

Australia.—According to the *Board of Trade Journal*, the Victorian Government has authorised the chief railway commissioner to make a five months' tour of Europe and America in order to study the working of electric railways. He was to leave Australia for England at the beginning of this month.

We are informed by Mr. W. G. T. Goodman, general manager of the Adelaide Municipal Tramways Trust, that the gross revenue for the half-year ended January 31st last amounted to £154,013, or £10,655 more than in the preceding half-year. The capital cost of the revenue earning portion of the undertaking was £1,279,710, and the surplus revenue over operating expenses, £52,610, or 8·33 per cent. per annum on the capital. We gather that the revenue was sufficient to meet the normal expenditure on the completed electric traction system as well as all statutory charges, including also interest on purchase money.

Bexley.—A reorganisation of the tramway service, suggested by the manager, has been agreed to by the Council.

Bingley.—The Shipley U.D.C. has given consent to an extension of the Bradford Tramway system from Nab Wood to Bingley, on condition that the Bingley U.D.C. pays it £150 per annum for the privilege. The Bingley Council has communicated this fact to the Bradford Corporation, which has approved the terms of the Shipley Council, and has agreed to pay the £150 annually to the Bingley Council during the term of the lease of the Bingley tramway to the Bradford Corporation.

Birmingham.—The year's working of the Corporation tramways resulted in traffic receipts amounting to £573,000, or £150,000 above those of the previous year. As concessions in fares amounting to over £70,000 were given during the year, it is not anticipated that the amount given to the rates will exceed that in the previous year, viz., £46,000.

Bournemouth.—A scheme for running railless trolley vehicles from the Square to Bournemouth Pier, and along the Undercliff Drive to Boscombe, has been before the T.C. The estimated cost is £18,600, and a net profit of £1,500 per annum is anticipated. The scheme was opposed, and has been referred to a Committee for consideration.

Bradford.—The general manager of the Corporation Tramways Department has had an interview with an inspector of the B. of T. in reference to the overturning of a tramcar at Allerton during a gale, and as a result the Tramways Committee has decided to provide wind gauges to indicate the prevailing wind pressure at various parts of the tramway system.

The Tramways Committee has also decided to accede to the suggestion of the Watch Committee that constables in uniform should be allowed to ride on the Corporation tramcars without payment of fares.

The preliminary statement of the working of the Corporation tramways for the year ending March 31st, show that the total receipts amounted to £289,616, an increase on the previous year's figures of £7,239. The number of passengers carried has been 62,000,000, an increase on the previous year of 6 millions. The increase is largely attributed to the establishment of the ½d. fares on cars boarded before 9 o'clock in the morning.

Burnley.—The tramway receipts for the year ending March 31st, 1913, are £7,190 more than last year, representing an increase of 1,481,000 passengers.

Bury.—Alderman Collinge announced at the T.C. meeting last Thursday that the tramway profits, Bury and Ratcliffe combined, for the year just ended, would reach £10,800. Of this, £9,500 was from the Bury system, and £1,300 from the Radcliffe system. Last year there was a combined profit of £8,550. Traffic receipts showed an increase of £1,250, and the working expenses a decrease of £1,000.

Canada.—Among Canadian railroads none are making more progress in the electrification of their lines than the Canadian Northern. This road is now making application for permission to take water from the Nicolum River, British Columbia, which joins the Coquahalla, about 11 miles from Hope, for the purpose of developing hydro-electric power. If sufficient power can be generated to operate the Rocky Mountain division by electricity, it is stated that the company will prepare plans for the construction of a power plant at Yale. It is also the intention of the company to tap Jones Lake in the mountains, to the south of the main line below Yale. From this they will be able to generate 50,000 H.P.

Continental Notes. — Italy.—La Società Elettrica Tranviaria Litoreana Viareggio-Versilia has secured a concession in respect of a projected electric tramway between Viareggio and Forte-del-Marmi, with a branch to Pietrasaito, a total distance of about 11½ miles.

Germany.—The Mersburg Ueberlandbahnen Gesellschaft is the name of a new company, with a capital of £65,000, which has been formed to work the new light electric railway, which is being built between Merseburg and Mucheln, Saxony, by the A.E.G. The line will be about 11½ miles long.

Dewsbury.—A communication has been received from the Batley Corporation to the effect that it cannot undertake the construction of a tramway line from the borough boundary.

The decision of the Corporation with regard to a physical junction between Shaw Cross and Westborough tramways is to be forwarded to the Batley Corporation, and the latter is to be asked whether it is prepared to submit an amended proposition.

Doncaster.—It was reported to the Council last week that Lieut.-Col. Druitt, of the B. of T., had inspected the new tramway extension to Bentley, and expressed satisfaction with it, and that the latter had been opened for service at a fare of 1½d. for the whole distance, the route being divided into two penny overlapping stages. In his Budget statement, Alderman Bentley, chairman of the Finance Committee, pointed out that the tramways had done well last year, coming out with a surplus of £471, after providing out of revenue £657 for a motor tower wagon. The Royal Show was a great help to the tramways. The estimated capital expenditure for the coming year included £43,186 for the extension of the tramways.

Halifax.—The receipts of the Corporation Tramway Department during the year ended March 31st, show a decrease in the profits of £3,839, as compared with 1911 (£14,182, as against £18,021). The total receipts were £105,970, as compared with £101,893 in 1911, while the expenditure had increased from £83,873 to £91,788. The number of passengers carried was 19,456,928, as compared with 18,749,456; the miles run were 2,152,391, as against 2,102,757. Amongst the expenses was included an item of £861 in connection with the abandonment of the Parliamentary Bill.

Hastings.—There seems no prospect of any agreement being arrived at between the Corporation and the tramways company in connection with the latter's Bill before Parliament for the adoption of overhead traction along the front line of the town in lieu of the Dolter system, which the B. of T. will only allow for a few months longer. The Bill is expected to be reached in the course of a few weeks, and present appearances point to a keen fight. The frontagers are backing up the Corporation in its opposition to overhead wires. In some quarters self-propelled tramcars are being advocated, and in others the preference is given to motor-buses. There is general agreement on one point—that the existing system, with its noise and "flashing," is most undesirable.

Leeds.—The returns for the year ending March 31st, according to a comparative statement just issued, show that the Corporation tramways have had another prosperous year. Following an increase in receipts last year of £24,000 (as a result of certain extensions), the increase upon the 1912 total has in the year just ended (when there have been no extensions) been £16,212. The receipts were £411,533. The number of miles run has been 8,795,465, an increase of 267,508. The number of passengers carried has increased by 3,646,242, having been 89,668,185, as against 86,021,943. The amount paid in fares per head of population had increased from 15s. 8d. to 16s. 3d.

The opening of the Lawnswood extension of the Corporation tramways has been delayed owing to the necessity of carrying out the recommendation of the B. of T. Inspector as to widening a portion of Otley Road to 60 ft.

L. and Y. Railway Electrification.—The Lancashire and Yorkshire Railway Co. has inaugurated new electric train services to Ormskirk, thus completing a through electrified system from Liverpool to Ormskirk. With the completion of the erection of the new battery station at the latter town a full service of express and stopping trains will shortly be substituted for the present limited number of trains.

London.— Camberwell.—The Borough Council has received a reply from the L.C.C. to its letter drawing attention to the dangerous condition of the tram tracks in the borough, more especially between Camberwell Green and Rye Lane, to the effect that it is proposed to relay the lines in Peckham Road within the next six months, but that in the meantime steps would be taken to maintain the existing lines safe for vehicular traffic. This reply is not considered satisfactory.

Hackney.—The L.C.C. has advised the B.C. that it proposes at an early date to commence the reconstruction, for electrical traction, of the existing horse tramways in a portion of Ball's Pond Road.

Manchester.—The question of traffic congestion in Manchester has engaged a great deal of attention recently, and a report by the Lord Mayor at the Council meeting last week contained a recommendation that the Chairmen of the Improvement and Buildings Committee, the Watch Committee, and the Tramways Committee, together with the Surveyor, the Chief Constable, and the Tramways Manager (assisted by the tramways permanent way engineer) be instructed to visit, at an early date, either collectively or separately, and make full inquiries in, other large cities in this country and abroad, and report the result for the benefit of the committees concerned, who could then prepare a joint report and recommendations to the City Council. The question was discussed for an hour, and several members strongly protested against the proposal to send deputations abroad. Ald. Bowes (Chairman of the Tramways Committee) said it might be that they would have to have 100 more cars, and they would have to consider the type of car best suited for the city. It would be reckless to build 100 double-deck cars, for it might be that in a few years they would have to scrap them for a small single-deck car. A resolution confirming the visits to cities in this country was adopted, but eventually it was decided to refer the whole report back for further consideration.

Merthyr.—The tramways aggregate receipts during the past quarter show an increase of £378.

Nelson.—A record in revenue in connection with the Corporation tramway undertaking is reported. The Committee estimated a profit of £450, but this has been exceeded by £1,000. During the 12 months 267,271 more passengers were carried than in 1911, in spite of the abnormally wet summer.

Newport (Mon.).—Mr. F. J. Young, manager of the Corporation tramways, has drafted a report in which, amongst other recommendations for increasing the revenue of the service, he suggests an increase of a ½d. in the fares on each of the stages of the various routes. It is also suggested that there should be an alteration in the charges for supply of electric power.

South Shields.—At a meeting of the T.C. on the 2nd inst., Alderman Wylie, in bringing up the report of the Tramways Committee, mentioned that quite recently they had completed seven years' working of the tramways. The last year, ended on March 31st, had been a record year, the revenue, which was over £30,000, was £1,500 more than it had ever been before. During the past seven years they had carried more than 50,000,000 passengers. During the past 12 months the traffic receipts amounted to £33,516, an increase of £1,472. The passengers carried numbered 8,456,688, an increase of 424,200, and the receipts per car-mile were 9·8d., an increase of ·4d.

Swansea.—The aggregate tramway receipts total £14,546 for the past quarter, showing an increase of £1,089.

Wallasey.—The T.C. is to receive a recommendation of the Parliamentary Committee that a scheme should be prepared for promoting a Bill in Parliament with the object of effecting a number of improvements. It is proposed, among other things, to extend the promenade to Harrison Drive, and to link up New Brighton and Wallasey Village by means of a tramway along the sea front. Powers will also be sought to run motor-omnibuses.

Wath.—The inhabitants of Wath appear to be very keen upon a system of railless traction being taken up by the Councils of Wath and the surrounding districts—Wombwell, Darfield, Bolton and Thurnscoe. The Council has agreed to a suggestion that the scheme should be under the control of the municipalities, and is agreeable to the expenses being equally divided between the five Urban Councils.

Wigan.—At a meeting of the B.C. on April 2nd, Ald. Ashton reported that, for the year, the total receipts from tramway fares had been £71,290, as against £66,328 for 1912, or

an increase of £4,961. The total receipts were £73,004, as compared with £67,664, an increase of £5,339. The total payments were estimated to be £72,452, and the estimated profit £551. That position was very satisfactory to the Committee and to the management. Councillor Bradshaw said he hoped the present position would be the beginning of better days for the tramways. Last year they lost over £4,000, and to have turned that into a profit of £500 was a splendid achievement.

TELEGRAPH and TELEPHONE NOTES.

Aids for Deafness.—It is said that deaf persons can hear better in one definite pitch than in others, and an instrument has recently been devised for the purpose of finding the exact pitch at which a partially deaf person's hearing becomes sensitive. It consists of a series of microphones, each having carbon balls of different size and quality, and a different internal resonance, in conjunction with a number of ear-pieces.

Australia.—The Commonwealth Court of Conciliation and Arbitration has resumed the hearing of the claims made by the Postal Electricians of the Federal Public Service, which was commenced as far back as August, 1912. The wages and conditions asked for are:—Mechanician, £450 per year; exchange foreman, maximum £400, minimum £250; foreman mechanic, maximum £400, minimum £250; inspector, maximum £400, minimum £250; senior mechanic, £222; mechanic, £192; junior and cadet mechanic, from £48 at 14 years of age, to £180 at 23 years of age. For batterymen, the wages claimed are:—Foreman batterymen, £222; batterymen, £172. Amongst the conditions asked for are that, where continuous day work is in existence, 44 hours shall constitute a week's work. Where time is worked over the stipulated hours it shall be paid for at the rate of time and a half for the first five hours, and after the first five hours double time. Where an officer is obliged, through no fault of his own, to remain in a grade for a period longer than five years, he shall be entitled to long-service increments of £10 for each five years he may remain in that grade. Entrance to the staff shall be by examination.—*Australian Mining Standard.*

Imperial Wireless System.—Mr. Harold Smith, Mr. Terrell and Mr. Harvey having resigned from the Select Committee on the Marconi Agreement, Sir F. Banbury, Mr. Butcher and Sir W. Essex have been appointed in their stead.

The scientific committee appointed to report on the merits of the existing systems of long-distance wireless telegraphy was at Copenhagen on Friday last, and visited the Poulsen station at Lyngby.

On Wednesday last week the Select Committee on the Marconi contract again examined Mr. Herbert Samuel, mainly with regard to the dealings in American Marconi Co. shares. He stated that the Treasury objected to the payment of a fixed royalty to the Marconi Co., regardless of the number of the company's patents in use, but the company would not agree to any reduction. Throughout the period between the acceptance of the tender on March 7th and the signing of the contract in July, communications were passing between the Government Departments and between them and the company with regard to the precise form of words to be adopted in the contract; that was the sole reason why the contract was not signed earlier than July 19th. Mr. Samuel stated that he had not personally met Mr. Godfrey Isaacs until December 11th, 1912, and that every interview between them had been minuted and sent to the Committee. He had no reason to suppose that his subordinates had been "got at" or approached by interested parties in any way. He could not account for the origin of the rumours that had been circulated alleging corruption on the part of his department and other Ministers. The British Marconi Co. had a licence for trans-Atlantic communication, and recently a licence for an experimental station in Ireland had been granted to the Poulsen Co. Licences were granted for one year only, but there was a reasonable expectation of their renewal. He first heard of the purchase of American shares about the end of July; he never attached any importance to it, regarding the companies as quite distinct.

On Thursday the Committee sat again, and took the evidence of brokers with regard to the America purchases, and on Monday further evidence of this nature was given.

Mr. Samuel made a statement regarding his previous evidence, explaining that a discrepancy as to the date when he first met Mr. Godfrey Isaacs was due to an oversight, whereby the report of an interview in August had not been included in the Blue-book which was presented to the Committee. It was an error on the part of a clerk. The Committee sat again on Wednesday.

Telephone Transfer.—The Court of Appeal has fixed April 15th for the hearing of cross-appeals arising out of the arbitration between the National Telephone Co. and the Postmaster-General, relating to the transfer of the telephone system to the Government.

Wireless Alarm.—Mr. Raymond Phillips, the inventor of a system of steering airships by wireless telegraphy, last week gave a demonstration of an instrument which distributes a danger signal capable of cutting out all wireless messages passing over a circle of 20 or 30 miles radius. Should there be no one on duty in the operating room, a siren is made to operate, arousing the officers and wireless experts to the fact that a neighbouring ship is in need of assistance.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—May 14th. Generating plant for Darwin Radiotelegraph Station, Northern Territory. See "Official Notices" to-day.

Victoria.—May 30th. High-tension switchgear with remote control, for the Melbourne City Council. See "Official Notices" March 28th.

April 15th.—1,020,000 arc lamp carbons, 26,900 carbon-filament incandescent lamps, and bare hard-drawn copper cables, for the Melbourne City Council. See "Official Notices" March 28th.

April 29th.—20,000 yd. of 3-in. fibre conduit, for the Melbourne City Council. See "Official Notices" to-day.

Sydney.—May 12th. Fibre conduit for the City Council. May 26th.—Meters and glazed stoneware bridges. July 7th.—Arc lamp carbons. Specifications 10s. 6d. for each section, from City Electrical Engineer's Department.—*Australian Mining Standard.*

Tasmania.—June 9th. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" to-day.

Queensland.—May 21st. Copper wire and accessories, for the P.M.G.'s Department. See "Official Notices" to-day.

Batley.—April 16th. The Electricity Committee invites tenders for general stores for the electricity works for 12 months. Mr. S. Derwen Jones, engineer.

Bedford.—April 23rd. Carbon and metallic-filament incandescent lamps, for a year, for the Corporation. See "Official Notices" to-day.

Belgium.—April 26th. The Belgian Post and Telegraph authorities (Salle de la Madeleine), Brussels, are inviting tenders for the supply of 1,200 m. of subfluvial and 240 m. of submarine electric cables.

April 29th.—The municipal authorities of Schaerbeek, near Brussels, are inviting tenders for the supply of a large quantity of armoured high-tension cable, and for the establishment and equipment of 11 static transformer boxes. Particulars may be obtained from the Service de l'Ingenieur, 30, Rue de la Ruche, Schaerbeek.

Bradford.—April 17th. Three-phase and continuous current switchgear for two sub-stations, for the Corporation. See "Official Notices" April 4th.

Bristol.—April 16th. Arc lamp carbons and incandescent electric lamps for a year, for the Bristol Docks Committee. Mr. W. W. Squire, engineer, Cumberland Basin.

Canada.—Winnipeg.—May 15th. City Light and Power Department. Two three-phase generators of 5,000 kw. for direct connection to 6,800-h.p. water turbines; also spare parts. Chairman, Board of Control. Deposit, £205. Particulars, Board of Trade Com. Intel. Department in London.

Dover.—The T.C. has decided to invite tenders for coal for the electricity works until April, 1914.

Dublin.—April 24th. High-tension and low-tension switchgear, cables and accessories, for the Corporation. See "Official Notices" to-day.

France.—Saint Juery, Tarn Department.—April 27th. The Municipality requests tenders for the supply of two groups of electric lifts (élevatoires électriques) and accessory piping (conduite d'aspiration). Particulars at the Mairie.

Rennes.—April 18th. Supply and erection at the port of St. Malo-St. Servan of two centrifugal pumps, two electric motors and accessory lines; also for electric plant for opening and closing sluice gates and sewer outlets, and for working a footbridge over the same. Particulars from the Ingenieur-en-chef des Ponts et Chaussées, 3, Rue de Fougères, Rennes, France.

Lisnaskea (Co. Fermanagh).—April 14th. Gas engine and suction gas plant, dynamo and booster, battery, wood poles, overhead mains, &c., and switchboard, for the Lisnaskea Electric Light Co., Ltd. See "Official Notices" March 28th.

Liverpool.—April 18th. Electric light and power installation at the Highfield Infirmary, Knotty Ash, for the Select Vestry. See "Official Notices" to-day.

London.—L.C.C.—April 15th. Electrical installation at Jeffryes' Almshouses, Shoreditch. See "Official Notices" April 4th.

April 23rd.—Electrical installation at Shadwell High Street Special School. See "Official Notices" April 4th.

Fulham.—April 23rd. 6,000 tons of nutty slack coal, for the B.C. Electricity Works. See "Official Notices" April 4th.

Southwark.—April 23rd. Two boilers, with fan, economiser and conveyors, two 1,500-kw. generators, four converters, switchboard, barometric condenser, cooling tower and steel structure, for the B.C. See "Official Notices" to-day.

Metropolitan Asylums Board.—April 23rd. Electric light installation in the Laundry Block and Block No. 12 at the Grove Fever Hospital, Tooting Graveney. See "Official Notices" to-day.

Manchester.—April 15th. (*a*) Tramway rail bonds; (*b*) Hard-drawn copper trolley wire; (*c*) Steel tramway poles; (*d*) Span drive brackets for tramway poles; (*e*) Granite setts. Mr. J. M. McElroy, General Manager. For (*c*) and (*d*) a deposit of £1 1s. is required.

April 23rd.—E.H.T. switchgear, low-pressure steam and water pipes, hot-well, valves, &c., and two 50-h.p. three-phase motors for cooling towers, for the Corporation. See "Official Notices" to-day.

(*Continued on page* 607.)

ELECTRICITY SUPPLY IN THE POTTERIES.

As many of our readers are, no doubt, aware, the modern Stoke-on-Trent came into being officially just three years ago, when the several contiguous towns, commonly known as the Potteries, and extending for a distance of about 10 miles along the Trent valley, were, by Act of Parliament federated into one county borough.

From the point of view of electricity supply, the amalgamation of the local government of these several adjoining towns, which comprise Burslem, Fenton, Hanley, Longton, Stoke and Tunstall, introduced a rather involved problem, not only because four of the towns had electricity undertakings in existence, three giving direct-current supplies in each case at a different pressure—(viz., Burslem, 220 and 440 volts; Longton, 230 and 460 volts; and Stoke, 240 and 480 volts)—

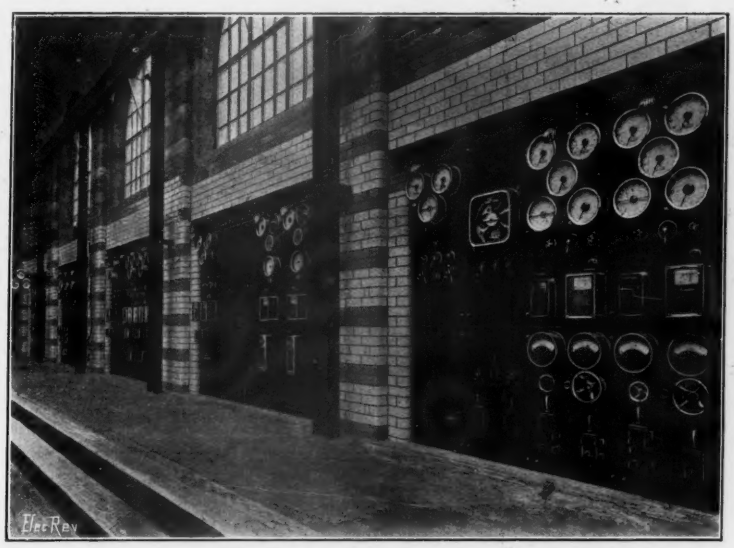


Fig. 1.—Three-phase E.H.T. Switchboard, New Power Station, Stoke-on-Trent.

and one an alternating-current supply (Hanley, single-phase, 100, 200 and 400 volts), but also by reason of the provisions of the Federation Act and the local conditions existing in the area.

As regards the Federation Act, a clause was inserted which compels the Gas and Electricity Committees in that area to so conduct the various works that no profit shall be made which can be handed over in reduction of the rates, and, in point of fact, each of the undertakings is conducted as a distinct business financially, not only the technical features but the charges for electricity varying in each concern, although, of course, the management of all is centralised under Mr. C. H. Yeaman, who took charge when the federation became an accomplished fact.

The Burslem works are about 3 miles north of the Hanley works, and the latter are $1\frac{3}{4}$ miles north of those at Stoke, and 3 miles north-west of those at Longton. From Burslem the district of Wolstanton, outside the federated area, is supplied, and Tunstall, while Fenton, lying between Stoke and Longton, is supplied from both these places, pending the completion of a scheme for H.T. supply which has been agreed on.

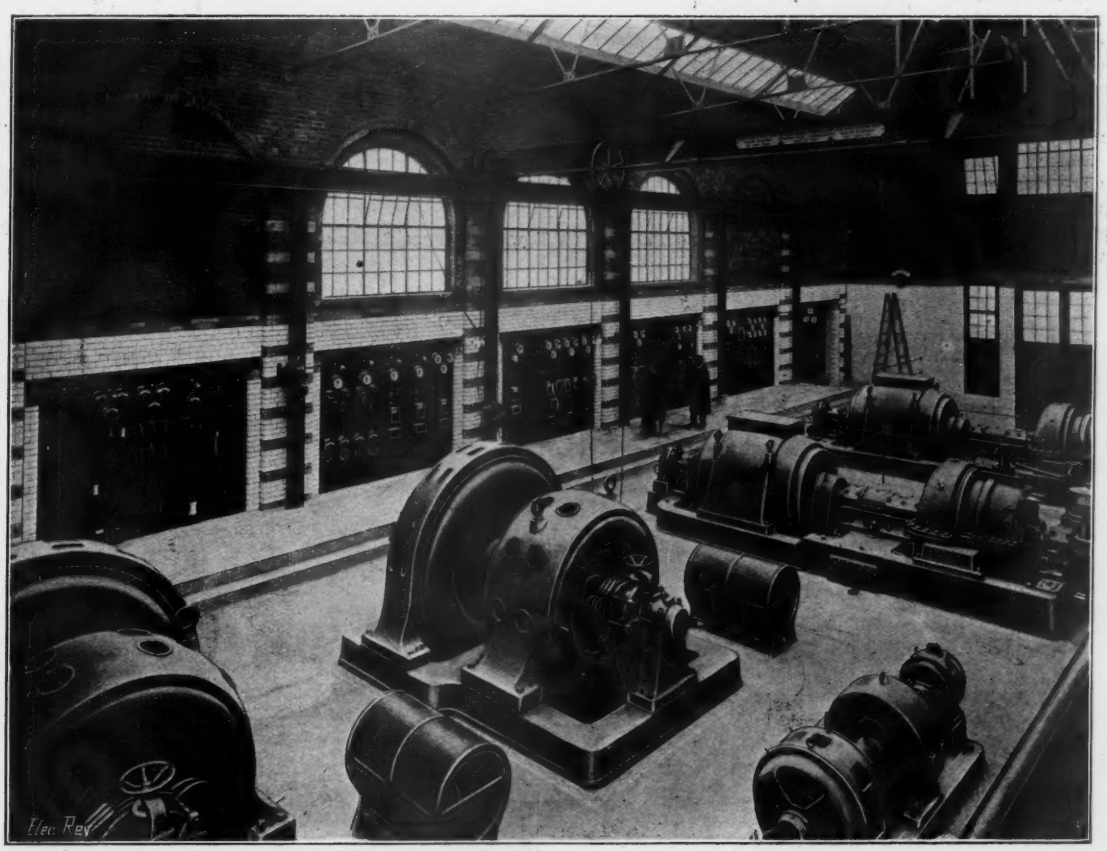


Fig. 2.—Interior of the New Power Station, Stoke-on-Trent, Showing the Turbine Plant, Motor-Generators and Switchboard.

The population of the combined area is 235,000, but despite this it has a comparatively low rateable value, and

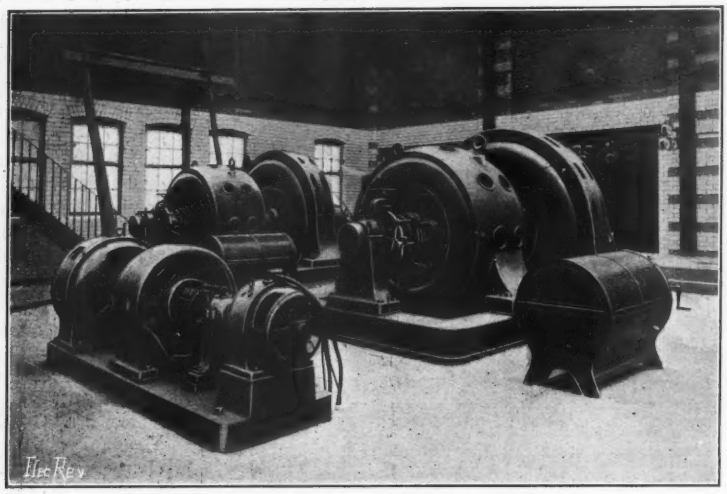


Fig. 3.—Three-phase to Single-phase Motor-Generators for Supplementing the Hanley Supply.

does not offer either in its inhabitants, who are mostly employed in the local pottery works, or in its industries, which employ a comparatively small amount of power, the scope for extensive electricity supply, which is found in some industrial boroughs having smaller populations. But once the federation scheme came into effect, it became necessary to settle on some definite future policy in regard to electricity supply in the area, in view of the future growth of the demand, and this by no means easy task fell to Mr. Yeaman, who, after considering various schemes, eventually recommended the provision of a central power station to supplement by means of bulk supplies delivered to the existing stations, the generating capacity of the latter. This arrangement enables the most economical adjustment of load as between the bulk supply and local stations to be made, each local station being debited with the actual cost of the supply given to it.

The bulk supply scheme which has been carried out on these lines at a cost of £60,000 approximately, was officially inaugurated yesterday; it includes a central power house, which has been built on land adjoining the original Hanley generating station, and contains turbo-generating plant supplying three-phase current at 50 cycles and 6,000—6,600 volts; three-phase transmissions to the original stations at Stoke, Burslem and Longton, where H.T. transforming and converting plant has been installed; also the provision of three-phase to single-phase converting plant in the power station itself for feeding the Hanley network through the adjacent station.

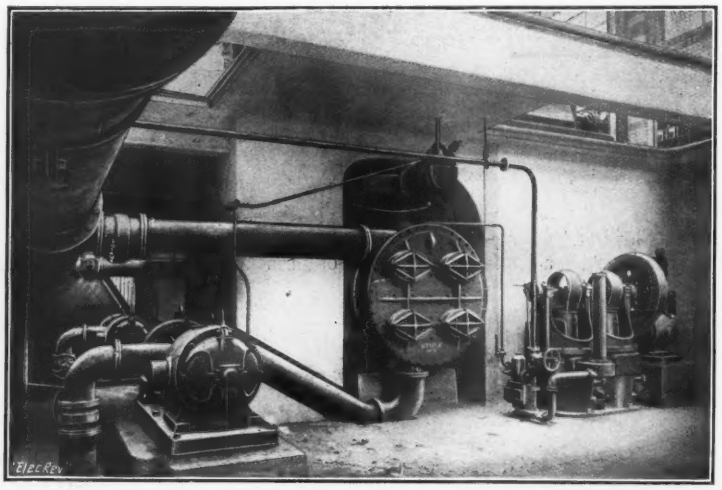


Fig. 4.—Condensing Plant, New Power Station, Stoke-on-Trent.

The plant installed at the new power station consists of three standard pattern five-drum Stirling boilers, each of 18,900 lb. evaporative capacity and designed for a working pres-

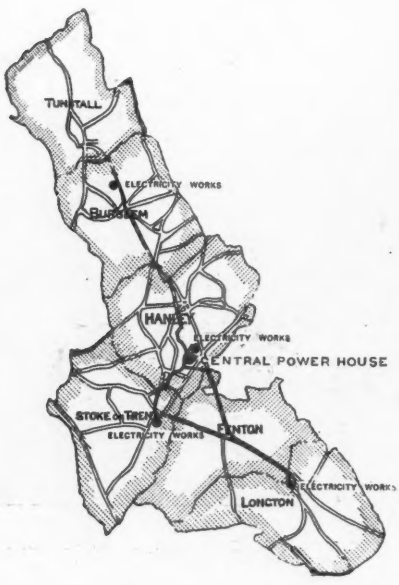


Fig. 5.—Skeleton Plan of the Federated Area, showing Existing Generating Stations.

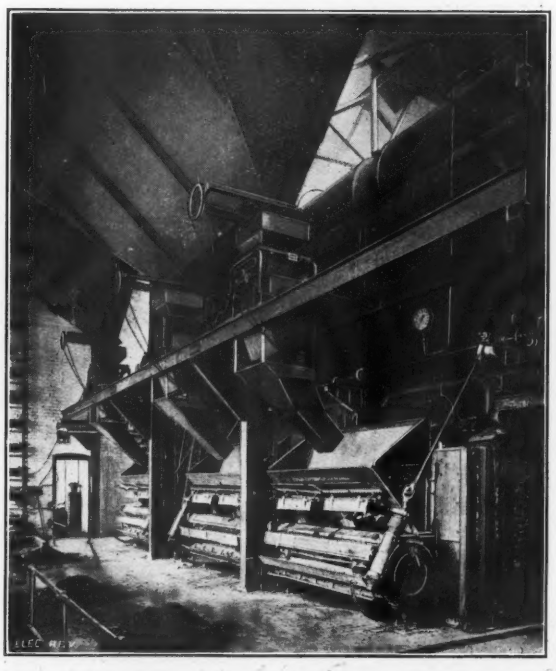


Fig. 6.—View of the Stirling Boilers, Coal Bunkers, &c., at the New Power Station.

sure of 200 lb. per sq. in.; the boilers are fitted with integral superheaters to impart a superheat of 120—150° F., travelling stokers by the Underfeed Stoker Co., and forced fan draught, and the burnt gases discharge through steel stacks standing 90 ft. high above grate level. Fuel for the station is obtained from local pits, the carts from which discharge into a hopper outside the boiler house; from the hopper the coal passes through a two-roll crusher on to a short tray conveyor leading to a filler, which feeds an ordinary endless bucket-pattern coal and ash conveyor running through the ash basement and over steel bunkers erected over the firing floor. The bucket conveyor has a capacity of 25 tons per hour.

From the bunkers, the contents of which will run the station for 48 hours, the coal falls by gravity through automatic weighing machines and spouts to the stoker hoppers in the usual way. The conveyor gear and bunkers were supplied by the feed-pump (5,000 gals. per hour) and a Westinghouse electrically-driven pump, also stores and offices.

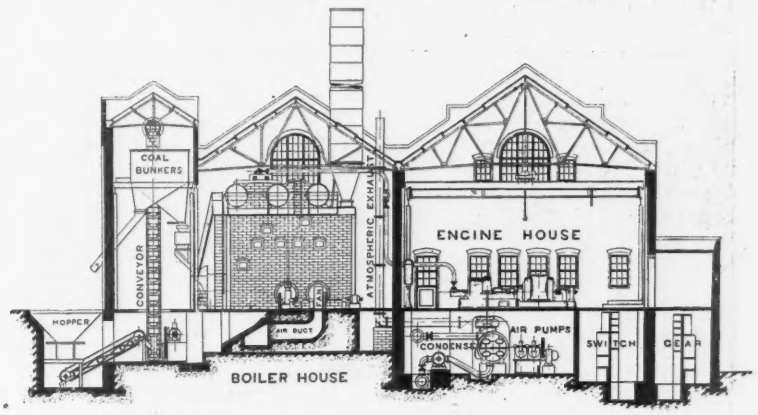


Fig. 7.—Sectional Elevation of the New Power Station.

In the engine room are installed two 1,500-kw. Howden-Siemens turbo-alternators, the turbines being of the Zoelly

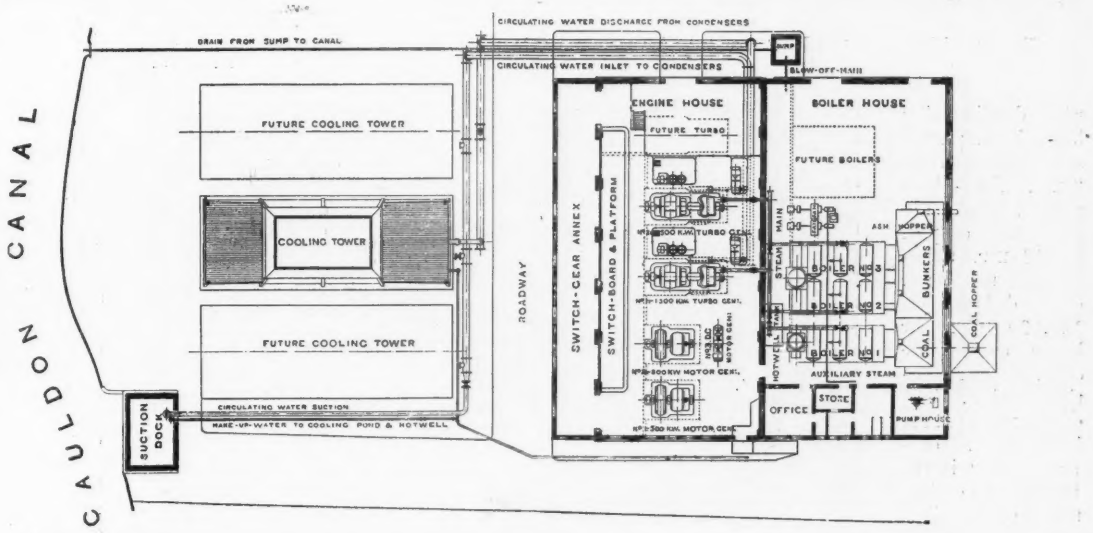


Fig. 8.—Plan showing the General Lay-out of New Power Station, Stoke-on-Trent.

New Conveyor Co. Our view, fig. 6, gives a good idea of the boiler plant at present installed; the building will accommodate two further boilers with the necessary bunker capacity, the ash hopper coming midway between the existing and future bunkers as shown in the plan, fig. 8.

At the permanent end of the boiler house (one end being temporary) is a pump room containing a Weir steam

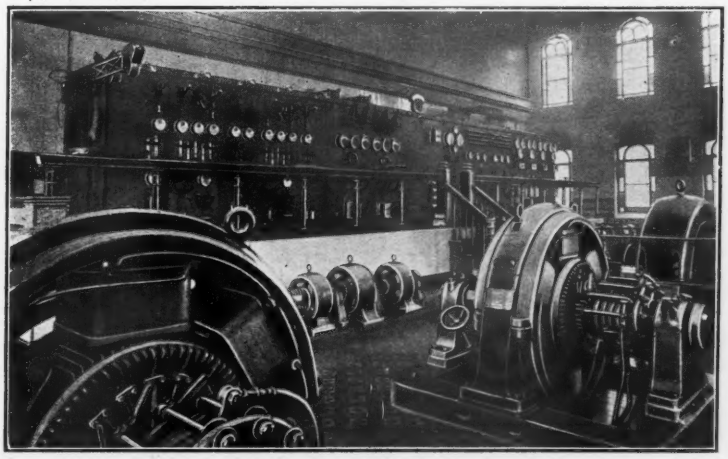


Fig. 9.—Switchboard, with Converters in Foreground, Longton.

impulse type (steam consumption, 16·8 lb. per kw.-hour on full load) coupled to three-phase totally enclosed generators constructed for forced ventilation with rotor fans and to run at a speed of 3,000 r.p.m.

Air filters in connection with these machines are situated in the basement and coupled up by means of ducts, and the cool air, which is drawn through the h.t. switch chambers, is, after passing through the machines, discharged into the engine room.

Each generator is rated at 1,500 kw. at ·8 power factor, and running at 3,090 r.p.m. delivers three-phase current at 6,000-6,600 volts, and 51·5 cycles. An overload capacity of 25 per cent. for two hours, or 50 per cent. for 10 minutes, and short circuit running on full-load excitation for one minute was specified.

With constant speed and excitation the inherent regulation is such that the pressure rise above 6,600 volts when full load is thrown off will not exceed at unity power factor, 8 per cent.; and at ·8 power factor, 22 per cent.

The exciters are of the overhung type, shunt wound and designed to work at 100 volts.

Each turbine exhausts direct into a surface condenser

situated in the basement below, where also are electrically-driven Mirrlees-Edwards twin air pumps and Rees Roturbo centrifugal circulating pumps. The former are combined with double-acting hot-well pumps, and are gear driven from 9-H.P. three-phase motors, while the latter are coupled to 48-H.P. three-phase motors, each delivering 132,000 gallons per hour over the cooling tower mentioned below. The condenser system is worked in conjunction with a Davenport cooling tower, one of three which can be accommodated between the existing buildings and the Cauldon branch of the Trent and Mersey Canal, which is situated about 150 ft. behind the station.

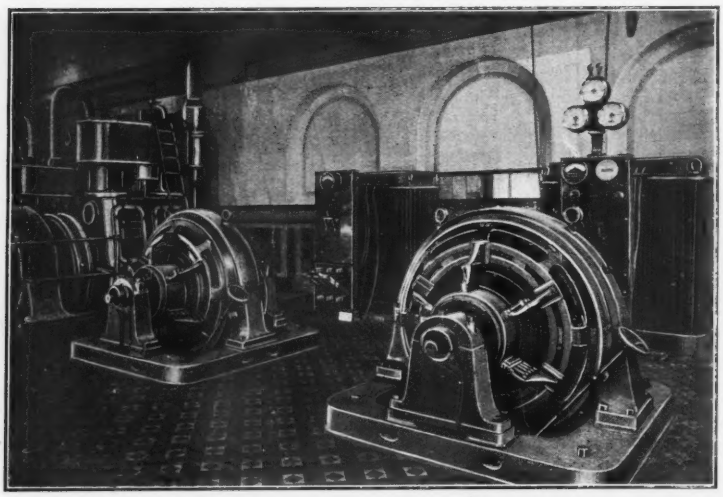


FIG. 10.—WESTINGHOUSE ROTARIES AND TRANSFORMERS, LONGTON STATION.

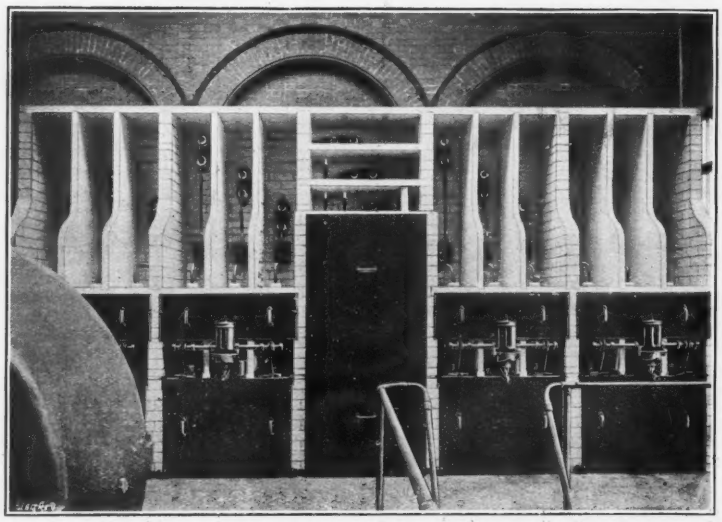


FIG. 11.—E.H.T. SWITCH CUBICLES AT THE OLD STOKE GENERATING STATION.

A special suction dock, fitted with an electrically-driven "Brackett" screen, has also been constructed on the canal side, so that circulating water can be drawn from the canal or cooling tower pond as required; a separate motor-driven pump is installed for supplying make-up water to the cooling pond and hot-well.

As previously mentioned, the new station also contains what is in effect sub-station plant for supplying the Hanley single-phase network. This consists of two 600-KW. Siemens induction type motor-generators; the motors run on the 6,600-volt 50-cycle three-phase supply, and drive single-phase machines with exciters, generating current at 100 cycles and 2,200 volts for supplementing the plant in the adjoining Hanley station.

The whole of the three-phase switchgear installed both in the new power station and local stations is of Westinghouse standard pattern, with remote-controlled solenoid-operated oil switches installed in masonry cubicles of the type shown in fig. 11. It has been designed and is guaranteed to break on a dead short with 9,000 KW. (*i.e.*, the ultimate capacity of the station) behind it.

The board consists of 15 panels, including two alternator panels equipped with the necessary switchgear, induction-type ammeters, polyphase indicating wattmeters, power-factor indicators, and integrating watt-hour meters. Two E.H.T. summation panels are fitted with Bristol recording voltmeters, frequency indicators, wattmeters, watt-hour meters and recording ammeters. An E.H.T. bus-bar coupler panel is fitted with a synchroscope and the necessary gear for paralleling the alternators.

A Brown-Boveri automatic pressure regulator is provided and arranged to control one, two or three turbo-alternators; it is provided with three double-pole change-over switches suitable for use in the exciter field circuits; one pressure and one current transformer.

There are four outgoing feeder panels, each fitted with polyphase overload and inverse time-limit relays; four further panels are provided for controlling the H.T. and L.T. sides of the two 600-KW. motor-generator sets installed in connection with the Hanley supply.

Five sets of Merz-Price protective gear are provided for future use in connection with the E.H.T. transmissions to the other stations.

An auxillary board controls the station battery, the secondary station transformers and distribution.

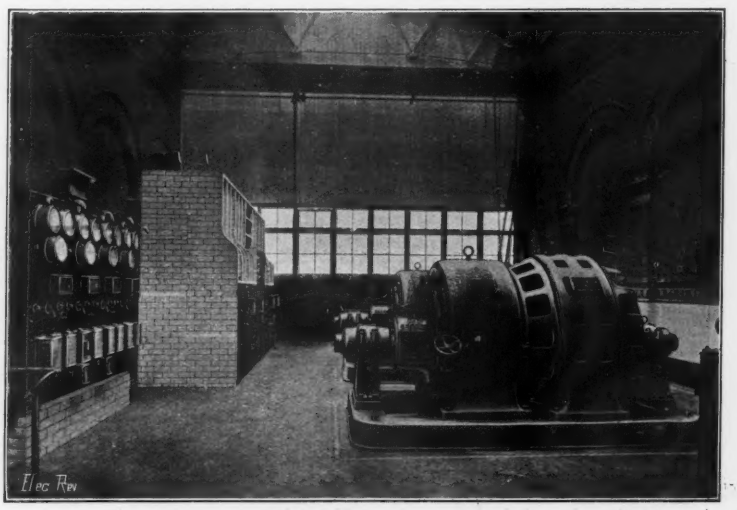


FIG. 12.—LA-COUR MOTOR-CONVERTERS, E.H.T. SWITCH CUBICLES AND CONTROL PANELS, AT THE OLD STOKE STATION.

The switch and bus-bar cubicles at the power house occupy two parallel basement chambers beneath the operating switchboard, as shown in fig. 7 ; the auxiliary current for excitation and operating the remote control is supplied by a battery of 60 D.P. cells, and 300 ampere-hours capacity, in connection with which a 50-KW. Peebles motor-generator is installed for charging purposes. Our view (fig. 2) gives a good idea of the interior of the engine room, a feature of which is the arrangement of the switch panels flush with the wall, and on a platform raised only slightly above the general floor level ; as will be seen, the engine room is excellently lighted, while the arrangement adopted also enables ample light to be obtained in the boiler house, and particularly on the firing floor, which is lighted by large side windows, and leaves nothing to be desired in this respect.

The whole of the three-phase E.H.T. mains running to the old stations were supplied and laid by Messrs. Callender's Cable Co. ; they are of the paper-insulated, lead-sheathed, wire-armoured type, laid on the solid system in stoneware troughing.

Outside the generating station, the cables were drawn into 3-in. pipes, and a number of spare pipes are provided for future requirements.

The ends of the feeders in each station are finished off in cast-iron dividing boxes, the connections to the bus-bars being made by single-conductor rubber-insulated lead-sheathed cables. Some 23,000 yd. of E.H.T. main have been laid, as well as a considerable number of L.T. distributor cables for 230-460-volt service.

As regards the original stations, the Burslem works were opened in 1905, and supply at 440 volts for power and 220 volts for lighting on the three-wire continuous-current system. The plant, in combination with a Heenan & Froude three-cell destructor, comprises four water-tube Babcock boilers, three Howden-Dick, Kerr generating sets respectively of 100, 200 and 350-KW. capacity and an exhaust and live steam Belliss-Siemens turbo-dynamo of 600 KW., with one Storey condenser.

The Hanley works were opened in 1894, and supply on the alternating-current system at 2,000 volts, 100 cycles, single-phase, and distribute from some 60 sub-stations at 400 volts for power and 100 or 200 volts for lighting. The plant consists of two Ferranti alternators with rotating armatures, respectively of 300 and 600-KW. capacity, and two Howden-Westinghouse 500-K.V.A. sets with rotating fields, each fitted with a condenser. Steam is raised in nine Lancashire boilers, three fitted with Bolton superheaters and three with Bennis mechanical stokers. Some of the plant in regular use has been at work nearly 19 years.

The Longton works are in the local gasworks yard and commenced supply in 1901. Supply is given at 460 volts for power and 230 volts for lighting. The system is a direct current one with three-wire distribution. The plant comprises three steam generators, two two-pole machines of 150 KW. each, and one multipolar machine of 300 KW., all of E.C.C. make and driven by Belliss engines ; three Babcock boilers fitted with chain-grate stokers. The station is run non-condensing. A Chloride battery takes the light loads.

The Stoke works were started in 1904, and supply power at 480 volts and lighting at 240 volts on a direct-current three-wire system. The plant consists of four Willans-Dick, Kerr generators, two of 150 KW. and two of 250 KW., with two condensing sets and a Tudor battery. Steam is supplied from one Lancashire boiler heated by the gases from three cells of a Meldrum destructor and two Babcock coal-fired boilers.

As regards the latter station, the engine room has been extended, and two 500-KW. La Cour motor-converters have been installed, together with three-phase and direct-current switchgear. Our views, figs. 11 and 12, show the general lay-out of this plant, fig. 11, in particular, giving a good idea of the cubicle work which is similar to that in the other stations.

The direct-current panels for the converters have been added to the original switchboard, situated on a gallery at the other end of the building. At Longton, two 300-KW. Westinghouse rotary converters with three-phase oil-cooled transformers have been installed, as shown in fig. 10 ; the necessary switch panels have been added to the original switchboard shown in fig. 9, the three-phase panels, as in the other cases, being of the remote-control pattern, with the oil switches in cubicles in this case in an annexe to the station.

The Burslem plant extensions consist of two 600-KW. Westinghouse rotary converters with starting motors, boosters, and exciters, and the necessary transforming apparatus, three-phase and direct-current switchgear ; this plant is arranged to run inverted in regular service, while the converting plant at Stoke could in emergency be similarly used.

Under Mr. Yeaman's management the commercial and technical control of the various undertakings has been centralised at St. Peter's Chambers, adjoining the Stoke-on-Trent Town Hall, where a complete suite of offices has been provided ; it is almost unnecessary for us to add that so far as detail organisation can be provided to ensure the efficient control of the various undertakings which, as previously mentioned, are financially independent, this has been provided by Mr. Yeaman.

The scheme which has been successfully carried to completion aroused very great interest locally. The Electricity Committee, of which Alderman Leece has been an indefatigable chairman, and Mr. Yeaman, its engineer, visited some of the best known electricity works in the country before submitting their proposals to the Council, and at a later date these were endorsed by Mr. J. F. C. Snell and thoroughly investigated by Mr. H. Ross Hooper at a Local Government Board inquiry, which resulted in the scheme being sanctioned.

It offers a satisfactory solution to a problem fraught with many difficulties, and undoubtedly places the federated towns in the best possible position, under existing circumstances, to develop their electricity supply undertaking on rational lines.

Our congratulations are due to Mr. C. H. Yeaman, the chief engineer, to whom we are indebted for facilities for preparing this short description.

CONTRACTS OPEN.

(*Continued from page* 602.)

Newcastle-on-Tyne.—April 23rd. E.H.T. three-phase lead-covered paper cable and single conductor L.T. lead-covered paper cable, for the Corporation Tramways Committee. See "Official Notices" to-day.

Newport.—April 26th. One 2,000-2,500-KW. steam turbo-alternator, surface condensing plant, one 600-KW. D.C. generator, and E.H.T. and L.T. switchgear, for the Corporation. See "Official Notices" to-day.

Salford.—May 19th. Tenders invited for 10 car bodies and 10 Brill trucks. General Manager, 32, Blackfriars Street, Salford.

Servia.—April 26th. The Servian telegraph authorities in Belgrade are inviting tenders for the supply of 125 km. (about 78 miles) of insulated copper wire.

South Africa.—DURBAN.—May 28th. Electric meter-testing equipment, for the Council. Copy of specification, &c., may be seen at Board of Trade Com. Intel. Dept. in London.

CLOSED.

Argentine.—The Argentine Government has accepted the tender of the Augsburg Maschinenfabrik Gesellschaft, of Augsburg, for the supply of no less than 75 electric cranes for the port of Buenos Ayres, with six sets of spares, at a total cost of £18,500.

Belgium.—Eight German firms and only one Belgian submitted tenders last week to the municipal authorities of Ixelles for the supply of a large quantity of low-tension armoured cable, the lowest offer being that of Messrs. Felten & Guilleaume, of Mulheim-am-Rhine.

Bury.—The T.C. has accepted the following tenders :—
W. T. Glover & Co., Ltd.—Cable.
British Westinghouse Co., Ltd.—Equipment for four cars.

Canterbury.—The T.C. has decided to purchase 13 of the General Electric Co.'s "Angold" electric arc lamps for main street lighting.

Barrow.—The T.C., on April 7th, approved of the acceptance of the tender of the B.I. and Helsby Cables, Ltd., for cable, at £1,324; also the offer of the British Westinghouse E. & M. Co., Ltd., for an additional 150-KW. rotary converter, together with the necessary rheostats, at £658; and for additional switchboards, at £183.

The Electricity Committee has accepted the following tenders:—

Engine and cylinder oils.—Jas. Light & Son, Ltd.
Crank chamber oil.—Stern-Sonneborn Oil Co., Ltd.
Metal polish.—Glaro Metal Polish Co., Ltd.
Shellac varnish, &c.—W. Geipel & Co.
Prepared tape.—A. Artsine.
Insulating compound, &c.—Dussek Bitumen Co.
Switches, &c.—H. C. Barlow & Co.
Tin lead fuse wire, &c.—Baxendale Bros.
Carbons.—Ship Carbons, Ltd.
Arc lamp globes, &c.—Falk, Stadelmann & Co., Ltd.
Joint boxes, &c.—Sykes & Sugden, Ltd.
Switch cut-outs.—B.I. and Helsby Cables, Ltd.
Electric meters.—Chamberlain & Hookham, Ltd.
Electrolytic midget meters, &c.—Reason Manufacturing Co., Ltd.
Tantalum, &c., lamps.—Drake & Gorham, Ltd.
Carbon-filament lamps.—Radium Electric Co.
Earthenware pipes, &c.—Doulton & Co., Ltd.
Linen tape and rubber gloves.—L. Andrew & Co.
Brass saddles and pins.—Veritys, Ltd.

Cape Town.—The following tenders were received for wiring the new factory of Lever Bros. (South Africa), Ltd., at Salt River:—

	Screwed conduit.	Close joint conduit.
R. M. Ross & Co.	(accepted) £225	—
Woods, Westerton & Co.	282	£251
Edward A. Shaw & Co.	322	291
Cunningham & Gearing	394	350
Clyde Engineering Works	398	380
R. G. Jack	419	454

The tenders of Messrs. E. A. Shaw & Co. have been accepted for wiring the new factory and offices of the Premier Gate Fence and Wire Co., Ltd., also for wiring the Council Chamber and the new offices of the Cape Rural Council.

Colchester.—The T.C. has accepted the following tenders:—

H. G. Merry & Co.—200 tons of Shirebrook nutty slack, at 15s. per ton, and 200 tons of Digby fidling nutty slack, 14s. 4d. per ton, for the electricity works.
Joslins, Ltd.—Electric lighting fittings, &c.
Williams & Co.—Rubber, fibre, &c.
Stanford & Co., Dick, Kerr & Co., Ltd, and Malleable Steel Castings Co.—Tramcar fittings.

The T.C. has accepted Messrs. Chamberlain & Hookham's tender for ordinary and P.P. meters.

Doncaster.—The Tramways Committee has accepted the tender of the United Electric Car Co., Ltd., for supply of four covers to existing cars, at £143 each.

East Ham.—The T.C. has accepted the tender of the Engineering and Equipment Co. for the supply of about 6 miles of figure-8 trolley wire, at 8¾d. per lb.

Glasgow.—The Tramways Committee recommends acceptance of the following:—

Copper trolley wire.—E. Le Bas & Co.
Copper strip.—Leslie & Hall.
D.U.C. wire.—London Electric Wire Co. and Smiths, Ltd.

Godalming.—Messrs. Rawlings & Co., of Lee, S.E., have secured the contract for installing plant and 400 to 500 lights and laundry motor and electric pump at Peper Harrow, Godalming, the residence of the Right Hon. Viscount Midleton.

Heckmondwike.—The U.D.C. has accepted the tender of the White Lea Colliery Co., Ltd., for 2,000 tons of coal for the electricity works, at 8s. 9d. per ton.

Leeds.—The offer of Messrs. Willans & Robinson, Ltd., for a turbo-alternator, condensing plant, pipes, &c., for £20,399, has been accepted by the Corporation.

London.—MARYLEBONE.—The tenders of the following have been accepted by the B.C.:—

Babcock & Wilcox.—Superheater, £500.
British Insulated & Helsby Cables, Ltd.—High-tension cable, £107 per 220 yds.
Union Cable Co., Ltd.—Ordinary underground cable.

The following tenders have been accepted for annual supplies to the Electricity Supply Committee:—

The London Electric Wire Co.—Fuse wires.
Sloan Electrical Co.—Arc lamp carbons.
Union Cable Co., Ltd.—Cables and pilot wires.
Dussek Bitumen Co.—Compounds.
Siemens Bros. & Co., Ltd.—Tapes, &c.
W. Lucy & Co., Ltd.—House service and main joint boxes, &c.
Sykes & Sugden, Ltd.—House fuse boxes.
Callender's Cable & Construction Co., Ltd.—Frames and covers.
British Electric Transformer Co., Ltd.—Transformers.
Ferranti, Ltd.—Meters and prepayment meters.
British Insulated & Helsby Cables, Ltd.—V.I.R. cables.
Edison & Swan Co., Ltd.—Accessories.
Geipel & Co., Ltd.—Arc lamp carbons.

BATTERSEA.—The B.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., at £1,920, for a water-tube boiler, fitted with superheater, chain-grate stoker and pipework, at the electricity station. The tender of Callender's Cable Co., Ltd., has been accepted for an annual supply of troughing and bends for cables, &c.

The contract for an automatic electric passenger lift in Admiralty House, Whitehall, the official residence of the First Lord of the Admiralty, has been secured by Messrs. A. W. Penrose and Co., Ltd.

Luton.—The T.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for two 1,000-KW. turbo-alternators, complete with condensers, &c., at £4,600 each.

Manchester.—The Corporation Rivers Committee has accepted the quotation of Electromotors, Ltd., for a 6-B.H.P. motor for the Withington works.

The Tramways Committee has accepted the tender of Messrs. Walter Scott, Ltd., of Leeds, for 2,500 tons of steel girder tramway rails.

The tender of Messrs. Thomas Anderson, Ltd., for the electric lighting of the George Leigh Street Municipal School, has been accepted.

Amongst a very large number of tenders for general stores and services, as required during the ensuing year, which have been accepted by the Tramways Committee, are the following:—

Dyer & Young.—Assembled commutator segments.
British Thomson-Houston Co., Ltd.—Motor and controller spare parts, motor cases.
L. Andrew & Co.—Fibre barriers and circuit-breaker handles, &c.
Dick, Kerr & Co., Ltd.—Motor and controller spare parts, &c.
British Westinghouse Electric and Manufacturing Co., Ltd.—Motor and controller spare parts, &c.
Estler Bros.—Controller fingers, &c.
Kay & Co., Ltd.—Motor brush-holders.
Manchester Armature Repair Co.—Armature and field coils.
P. R. Jackson & Co., Ltd.—Armature and field coils.
Electro-Mechanical Brake Co., Ltd.—Grid resistances.
H. Wallwork & Co., Ltd.—Grids for resistances.
Brecknell, Munro & Rodgers, Ltd.—Trolley poles, &c.
General Electric Co., Ltd.—Incandescent lamps, bells, lighting material, telephones, testing instruments, &c.
Commercial Electric Co., Ltd.—Incandescent lamps, traction type.
S. Gratrix, Jun., & Bro., Ltd.—Bell presses, arc lamp globes, sundry glass, &c.
C. Macintosh & Co., Ltd.—Cells, insulation tape, goloshes, rubber gloves and gauntlets, &c.
Eckstein, Heap & Co., Ltd.—Spare parts for Gilbert arc lamps.
Meirowsky & Co.—Amber mica segments for commutator bars, &c.
Sutcliffe (Crumpsall), Ltd.—Fibre sheets and stick fibre.
Spicer Bros., Ltd.—Red fibre paper, leatheroid strips, insulation paper and cloth.
British Xylonite Co., Ltd.—Celluloid.
Connolly Bros., Ltd.—P. and B. tape, power and lighting cables.
I.R., G.P. and T.W. Co., Ltd.—Linen tape.
Pinchin, Johnson & Co., Ltd.—Insulation varnish.
R. W. Blackwell & Co., Ltd.—Insulating compound.
Morgan Crucible Co., Ltd.—Carbon brushes, &c.
Baxendale & Co., Ltd.—Arc lamp carbons, turpentine, &c.
Alfred Wiseman, Ltd.—Overhead equipment insulating material, pole switches.
General Patents Co.—Trolley heads.
Fleming, Birkby & Goodall, Ltd.—Trolley wheel bushes and spindles.
Souper & Callaghan.—Automatic sanding devices.
John Taylor.—Tubular sand controllers.
Hudson & Bowring, Ltd.—Automatic life-guards.
Philipson & Co.—Folding side-guards.
T. Bolton & Sons, Ltd.—Copper wire, copper strip and sheet copper.
C. Clifford & Son, Ltd.—Brass wire.
F. Smith & Co., Ltd.—Steel wire.
Richard Johnson & Nephew, Ltd.—Galvanised steel wire cable and rope.
I. Bentley & Co., Ltd.—Lubricating oils, &c.
J. Stoddart & Son.—Paraffin oil.
British Petroleum Co., Ltd.—Motor spirit.
Hardman & Holden, Ltd.—Creosote oil.
Newton, Chambers & Co., Ltd.—Disinfecting fluid and powder.
Reliance Manufacturing Co.—Liquid metal polish.
Till & Whitehead, Ltd.—Sundry workshop tools, plant and appliances, &c.
Carborundum Co., Ltd.—Special blocks for grinding steel rails.
London Emery Works Co., Ltd.—Special wheels for grinding steel rails, &c.
West Bromwich Spring Co., Ltd.—Truck springs, &c.
J. Billingham.—Brake chains.
Brampton Bros., Ltd.—Gear chains for brakes.
Milnes, Voss & Co., Ltd.—Car fenders.
Cammell, Laird & Co., Ltd.—Tramcar axles.
J. Brown & Co., Ltd.—Tramcar wheel tires.
F. W. Rowlands & Co.—Gear and pinion wheels.
National Rail and Tramway Appliances Co., Ltd.—Iron castings, brake block castings.
Interchangeable Brake Block Co., Ltd.—Chilled iron brake block castings.
Moston Malleable Castings Co.—Malleable iron castings.
Leys Malleable Castings Co., Ltd.—Gear-case castings.
S. Peace & Sons, Ltd.—Steel castings.
Armstrong Oiler Co., Ltd.—Lubricant pads for axle boxes.
J. Carr & Sons, Ltd.—Trolley cord.
Chamberlain & Hookham, Ltd.—Ampere-hour tramcar meters.
British Oxygen Co., Ltd.—Oxygen gas and acetylene gas.
Thermit, Ltd.—Thermit welding material.

Warrington.—The B. of G. has accepted the tender of Mr. H. Bibby for electrical fittings and sundries for six months.

Nelson.—The T.C. has accepted the tender of Messrs. Briggs, Jones & Gibson, of Manchester, for uniforms and caps for the Light Railway men.

Newport (Mon).—A contract for carbon-filament lamps and radiator lamps for the Corporation Electricity and Tramways Department for the ensuing 12 months, has been placed with Messrs. Siemens Bros. Dynamo Works, Ltd.

Plymouth.—The Electricity and Street Lighting Committee has accepted the following tenders received for the supply of stores and materials during the ensuing financial year:—

Carbons.—Crompton & Co.
Engine waste.—Northern Waste Co.
House meters.—Ferranti, Ltd.
Oil, &c.—A. Hopps & Sons, Ltd.; Stern-Sonneborn Oil Co.; and M. Wells and Co.

The chairman and the electrical engineer were authorised to purchase one ton of electrolytic copper and half a ton of sheet copper.

Russia.—ST. PETERSBURG.—It is stated that the municipal council of St. Petersburg has placed an order with the Russian A.E.G. for the supply of tramcars of the value of 905,000 roubles (£90,500). Orders have also been allocated to the firm of Fitzner and Gambert, which is closely associated with the German Borsig Works, of Tegel, for the sum of 871,980 roubles (£87,198), and with the Russian Westinghouse Co. for the amount of 815,427 roubles (£81,542).

Sheffield.—The City Council has accepted the tender of Messrs. R. White & Sons, at £587, for the construction of an aerial ropeway at the Neepsend power station.

Quotations have been received from the Post Office, amounting to £965 15s. per annum, for installing 50 fire alarms with boxes, and to £999 15s. per annum for 50 fire alarms with pedestals, on a ten years' agreement. The consideration of the quotations has been deferred pending the result of further inquiries about the "Gamewell" system.

Southend-on-Sea.—Mr. G. Braulik has received a contract for his current limiters for the Corporation for the next two years. He has been supplying these limiters to the Corporation for several months past.

Stretford.—The U.D.C. has accepted the tenders of the Union Cable Co., amounting to £706 and £67, for supplies of cable.

Watford.—The U.D.C. has accepted the tender of the Union Electric Co. for a motor-generator, at £190, and that of the Electric Construction Co., for new machine panels and reconstructing existing panels.

Woolwich.—The B.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., at £7,865, for two boiler units, with chain-grate stokers, for the electricity department. With reference to the supply of current to the L.C.C. hostels at Eltham, referred to elsewhere, the tender of the British Electric Transformer Co. has been accepted, at £114, for four air-cooled transformers.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, April 11th. At 39, Victoria Street, S.W. Paper on "Methods of Regulating and controlling Working of Electric Accumulators," by Mr. G. C. Allingham.

Saturday, April 19th.—At Caxton Hall, Westminster. Bohemian smoking concert.

Physical Society.—Friday, April 11th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "Some Errors in Magnetic Testing due to Elastic Strain," by Messrs. A. Campbell and H. C. Booth, and "Note on Cathodic Sputtering," by Dr. G. W. C. Kaye.

Institution of Electrical Engineers (Scottish Section).—Tuesday, April 15th. Annual general meeting.

(Newcastle Section).—Monday, April 14th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "The Formation of Deposits in Oil-Cooled Transformers," by Dr. Michie.

(Students' Section, London).—Wednesday, April 16th. At 7.45 p.m. At the Institution, Embankment, W.C. Paper on "Alternating-Current Railway Signalling," by Mr. T. J. Hornblower.

Illuminating Engineering Society.—Tuesday, April 15th. At 8 p.m. At the Royal Society of Arts. Paper on "Standard Clauses for Inclusion in a Specification of Street Lighting," by Mr. A. P. Trotter. Discussion open to members of the I.E.E., I.G.E. and I.M. and C.E.

Electrical Trades Benevolent Institution.—Wednesday, April 16th. At 7 p.m. At the Trocadero Restaurant. Festival dinner. Tickets from the Secretary, 18, Park Mansions, Vauxhall Park, S.W.

Institution of Mechanical Engineers.—Friday, April 18th. At 8 p.m. Address by the President.

Royal Institution.—Friday, April 18th. At 9 p.m. Discourse on "Applications of Polarised Light," by Dr. T. M. Lowry.

Association of Engineers-in-Charge.—Saturday, April 12th. At 6.15 p.m. At the Holborn Restaurant. Annual dinner.

Saturday, April 19th. Social. Bohemian concert.

Association of Electrical Station Engineers (Bradford Section).—Tuesday, April 15th (? Wednesday, April 16th). At 7 p.m. Meeting at the Mechanics' Institute, Bradford.

(Manchester Section).—Thursday, April 17th. At 7.30 p.m. Meeting at the Exeter Café, Deansgate, Manchester.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued:—

Monday, April 14th.—"A" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Tuesday, April 15th.—"B" Company. Company training, 7 to 10 p.m.

Thursday, April 17th.—"C" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Friday, April 18th.—"D" Company. Company training, 7 to 10 p.m.

Saturday, April 19th.—Headquarters will be opened for regimental business from 10 a.m. till noon.

(Signed) P. H. Campbell, Capt. R.E., and Adjt.
For Officer commanding L.E.E.

Radium Treatment.—Dr. Saubermann, of Berlin, lecturing before the members of the Röntgen Society, recently stated that water containing radium emanation had great possibilities. The water was artificially charged with radium emanation to a much higher degree than the water found in any natural spring. On the Continent remarkable results had been attained by this treatment in the whole range of diseases of metabolism, including gout, rheumatoid arthritis, nephritis and arteriosclerosis.

NOTES.

Reduction in German Wire Lamp Prices.—After the lapse of a year and a half since the last reduction in the prices of metallic-filament lamps was made by the principal makers in Germany, further concessions have now been granted in that country. As on previous occasions, the initiative in the matter has again been taken by the A.E.G., which states that the new prices are 1s. 1d. for lamps of 5 to 10 c.p., as compared with 1s. 6d. hitherto, 1s. 9d. for lamps of from 10 to 50 c.p., as against 2s. 6d., and 2s. 6d. for lamps of 100 c.p., as contrasted with 3s. 6d. The company explains that the very considerable increase in the sales both at home and abroad, as well as the introduction of the drawn metallic wire, has brought about a cheapening of the cost of production, which permits of sale prices being reduced. Merchants require reliable gross prices and a rebate, which as far as practicable is to represent their profits. The company wishes to place a limit on the present uncertainty of the market by regulating the rebates in connection with the reduction in the gross sale prices. It will perhaps be remembered that the previous price concessions were made in October, 1911, when the right of use of the wire lamp-patents of the United States General Electric Co. was secured by the A.E.G., the Siemens & Halske Co. and the German Incandescent Gas Light (Auer) Co., and this privilege was subsequently extended to the Bergmann Co. The action of the A.E.G. on the present occasion has been speedily followed by the Siemens & Halske Co., which also announces a reduction of 25 per cent. in the prices of Wotan and tantalum lamps, whilst a lowering of the net prices charged by the Incandescent Gas Co. has likewise been made, although not to the same extent.

The price reduction on the Continent will not be followed by a price reduction in England, as the patent situation here is entirely different.

Inquiries.—A correspondent asks where "manu marble" can be obtained. Another correspondent asks for addresses where model electric laundries may be seen.

Electric Lighting Installation.—In reference to the case of Watson *v.* Claytons, reported in these columns on March 21st, the plaintiffs, Messrs. Watson, Marsh & Co., 347, High Road, Brondesbury, write to say that the claim of £60 was for a complete inside installation of incandescent lighting, together with four outside arc lamps with special covers. Messrs. Claytons claimed that the contract had not been carried out, inasmuch as the special arc lamp covers were not as per Messrs. Lockwood and Bradley's pattern, whereas Messrs. Watson, Marsh & Co.'s case was that Messrs. Lockwood & Bradley's covers were not specified by them, and that in any event those covers, being an extra charge over and above those ordered by them, had nothing to do with the amount claimed by them.

Foreign Trade in March.—Last month's trade returns show an increase of £180,531 in imports, and one of £975,976 (2·3 per cent.) in exports, but it is not possible to make a fair comparison with 1912, for last year the coal strike was in progress. We may, however, select the electrical and machinery figures from the published reports, as below. From these it appears that although there are two working days less in the 1913 reckoning, the export figures are very substantially higher:—

Imports.

	Month of March.	Inc. or dec.	Three months, 1913.	Inc. or dec.
Electrical goods and apparatus, excluding machinery & uninsulated wire ...	£117,190	— £19,080	£374,339	— £36,922
Machinery... ...	639,942	+ 31,975	1,833,892	+ 201,409

Exports.

Electrical goods and apparatus, excluding machinery & uninsulated wire ...	£815,673	+ £153,015	£1,510,256	+ £349,518
Machinery... ...	2,764,960	— 34,212	8,590,063	+ 777,593

The Batti-Wallahs.—At the informal meeting of the Batti-Wallahs' Society, on Wednesday last week, during the evening, between the other turns, stanzas caricaturing certain members were read, much to the amusement of the company. The next function—a smoking concert—will be held at the Holborn Restaurant, on Friday, April 18th, and not April 28th, as stated in the official programme. This is the last smoking concert of the season.

Fatality.—Ushaw Moor.—An inquiry was held at Ushaw Moor, Co. Durham, on the 3rd inst., by Mr. R. A. Shepherd, Deputy Coroner, into the circumstances of the death of Clarence Herbert Allen, 18, an electrical improver, who was killed at Ushaw Moor sub-station on the Monday preceding. Norman Vincent Raven, of Elden Place, Newcastle-on-Tyne, supervising electrical engineer for the Newcastle Electric Supply Co., said he was in charge of a contract which Messrs. Reyrolle & Co., of Hebburn-on-Tyne, were carrying out for his company at Ushaw Moor, and he gave instructions for the carrying-out of the work. There were three chambers, and the 20,000-volt chamber was reached from the transformer chamber by a wooden staircase. He had told the jointer that he must not go into the 20,000-volt chamber, and gave instructions that the pilot cable was not to be drawn into that chamber unless the inspector was present. Alphonsus Lawton, jointer, of Sunderland, said that on Monday he was told by the foreman to proceed with work on a 5,000-volt cable, and that if

necessary he was to get assistance. Finding he could not get assistance, he proceeded with the drawing of the pilot cable into the 20,000-volt chamber. He knew that certain parts of the switchgear were "alive." Allen had to pull the pilot cable through a hole, and witness told him not to go near where the live contacts were, and not to go higher than the switch, but just to stand on the floor of the chamber. After Allen had pulled the cable partly through, he asked, "Have I got enough?" Witness replied that he would be there in a minute, and went upstairs, when he heard a hissing noise. On getting into the 20,000-volt chamber, he was surprised to see the youth on top of the switch, in a kneeling position, with his head about 5 in. from the "live" contact. He gave Allen a slight pull by the coat, and saw the sparks pass from the contact to his head. There was no need for Allen to get on the top of the switch. What he should have done was to have knelt underneath the switch, and pulled the pilot cable through. Allen was badly burned, and although artificial respiration was applied, it was unsuccessful. Witness had a danger pass with him, but it was not signed, as there was no one there to sign it. Mr. Robinson (representing Messrs. Reyrolle) complimented witness for his brave act in attempting to pull Allen away from contact with the electric current. The Coroner said it would appear to have been easier to pull the cable above the switch rather than underneath. Apparently the deceased had got on top of the switch, and in pulling the cable through probably he had tilted his head, and caught one of the contacts. He expressed the opinion that they could not attach blame to anyone, as it seemed to have been a pure accident. The jury returned a verdict of "Death from accidental electrocution," and recommended that there should be more safeguards at the sub-station, and that the rules should be more stringently enforced. Although Allen was employed by Messrs. Reyrolle, he was not at the time of the accident working upon switchgear of their make.

Sheffield.—According to the *Sheffield Daily Independent* an explosion occurred at the Devonshire Works at Staveley on Wednesday last week. From facts elicited at the inquest it appears that when the accident occurred several men were engaged in turning steam from an engine into an exhaust turbine. In order to do this they had to close one valve and open another. The men stood on the top of an oil separator, about 12 ft. from the ground. Martin Stops, 20, a fitter, happened to step back, and got pinned between two parts of the valves. Mr. Ronald Fowler, the engineer-in-charge, said that when the deceased was pinned, he called out to another man to tell the engineman to stop the engine. Whilst witness's back was turned a man named Wilson closed another valve, with the result that there was no outlet for the steam. They had no time to jump from the separator before an explosion occurred, and they were all thrown to the ground. Being pinned, Stops received the full force of the explosion, and he died soon afterwards. The Coroner said that Wilson seemed to have lost his head in closing the valve on his own authority. The jury returned a verdict of "Accidental death."

Annual Dinners and Socials.—London.—At the Pier Hotel, Cheyne Walk, Chelsea, on March 15th, the third annual dinner and concert of the Underground Electric Railwaymen's Sick Benefit Club was held. Mr. J. W. Towle, chief engineer, presided, and he was supported by Mr. P. R. Wray, sub-station engineer, Mr. T. O'Reilly (club secretary), Mr. A. McCutcheon (treasurer) and others, the company numbering nearly 100. The toast "The Power Station" was proposed by Mr. S. L. Phillips (shift engineer) and responded to by Mr. Wray. "The Club" was proposed by Mr. McCutcheon, and the club secretary replied, thanking all who had contributed to the success of the annual dinner and referring to the continuous increase in membership since the club was started in 1906. The number of members for 1912 was 168; the sick pay was £43 19s. 6d. and funeral allowance £15 8s., leaving a surplus returned to each member at the end of the year of £1 8s. 4d. After the toast of "The Chairman" had been disposed of the gathering enjoyed a programme arranged by Messrs. Cooper and Nash.

The fourth annual Bohemian Concert in connection with the Electrical Installations, Ltd., Athletic Club, was held on April 7th, at the Oval Hall, Kennington. Before an audience of some 300 to 400 people, consisting of the staff and their friends, an able body of entertainers carried through a most excellent variety programme. At the opening of the proceedings Mr. Stanley C. Russ, president of the Club, alluded in a few suitable words to the successful development of the club, and informed the members that he had been successful in his negotiations with the City of London Cricket Club, in renting a portion of their exceptionally fine ground at Acton on behalf of the staff, and also that the E.I., Ltd., Cricket Club had entered for the Western League.

Institution and Lecture Notes.—Association of Consulting Engineers.—The report of the Committee for the year 1912, which has just been issued, recapitulates the circumstances under which the Association came into existence, and gives the qualifications and duties of members, as well as the definition of a "consulting engineer." An International Congress of consulting engineers and engineering experts is to be held at Ghent during the running of the Exhibition there this year, and the creation of an International Federation of Associations of Consulting Engineers is contemplated. The Association numbered 80 members at the close of the year, and is the largest society of its kind in existence. The Committee was unable to accept the Standard Conditions of Contract prepared by the B.E.A.M.A., holding that it is not possible to frame one set of conditions applicable to all contracts. The Committee was requested to draw up a scale of professional fees for the use of members, but decided that it would not be advisable to attempt to stereotype rates of remuneration. Referring to a recent incident in Parliament, relating to the employment of Government officers to give advice as consulting engineers in their private capacity, the Committee comments on the disadvantages of the practice, which in future is not to be followed without the consent of the head of the Department concerned. The fact that the obligation to pay an engineer's fees is outside the jurisdiction of taxing masters is pointed out by the Committee. It is proposed to issue reports to the members from time to time, dealing with subjects of interest to them. The accounts for 1912 show income £130, expenditure (covering also 1908-11, £38) £113, balance £17. A full list of members is appended to the report, together with the code of ethics of the American Institute of Consulting Engineers and their schedule of fees. A little booklet containing the rules and practice of members of the Association has been issued, to enable them to put these before their clients and others.

Association of Mining-Electrical Engineers (East of Scotland Branch).—At the last monthly meeting, at Dunfermline, a paper by Mr. H. G. Humphry (H.M. Junior Inspector of Mines) on the 'Supervision of Electrical Plant," was discussed. In reply to criticisms, Mr. Humphry said that sets of printed instructions similar to those suggested in his paper would tend to lighten rather than increase the responsibilities of managers. In reply to a remark that persons authorised to work switchgear under Rule 11 should not be allowed behind a switchboard for the purpose of cleaning, the Inspector thought that this was a question that must be decided by each manager for himself.

Society of Engineers (Inc.).—An essay on "How to Improve the Status of Engineers and Engineering, with Special Reference to Consulting Engineers," was read by Mr. W. Ransom on Monday, April 7th. This was awarded the second prize in the Status Prize Competition last year, no first prize having been awarded.

Greenock Electrical Society.—This Society held its business and social meeting on March 28th, with Mr. J. A. Robertson, the honorary president, in the chair. After tea the chairman congratulated the company upon the success of the Society since it was formed last year. He knew of no business or profession in which it was more necessary that there should be a free interchange of opinion among the members than electrical engineering, for it had more problems requiring discussion than any other branch of engineering. The Society was primarily intended for the benefit of the younger members of the profession, who would obtain knowledge from the experiences of older members. The syllabus showed that subjects dealing with nearly every branch of applied electricity, from wireless telegraphy and electric cooking down to the more prosaic worries of a shift engineer, were dealt with. The chairman concluded with a reference to the services of the president (Mr. J. H. Parker) and the secretary (Mr. W. B. Smith). The secretary's report showed that there were 17 hon. members and 77 ordinary members. Twelve meetings were held, with an average attendance of 37. Six visits were paid to works. Mr. W. A. Toppin has been appointed this year's president, and Mr. A. Hurry secretary, Mr. Robertson continuing as hon. president.

Institution of Mechanical Engineers.—The summer meeting of this Institution will be held in Cambridge from Monday, July 28th, to August 1st. A provisional programme has been issued regarding receptions, a garden party, excursions to Ipswich and Bedford, and visits to works, laboratories, &c., in Cambridge.

Iron and Steel Institute.—The programme of the annual meeting of this Institute shows that the proceedings will open on Thursday morning, May 1st, at the Institution of Mechanical Engineers, Storey's Gate, S.W. The daytime will be occupied with papers and discussions, and at night the annual dinner will take place at the Hotel Cecil, Mr. Arthur Cooper, the president, presiding. The meeting will continue on May 2nd. Among the papers that are down for reading is one by Mr. Andrew Lamberton, on "A New Form of Electrically-driven, Two-high, Continuous-running, Reversing Mill"; also one by Dr. J. Puppé entitled "Rolling-Mill Practice in the United States, Part II." The autumn meeting of the Institute takes place at Brussels, from September 1st to 5th.

Institution of Electrical Engineers (Manchester Section).—The annual meeting of the above Section was held on Tuesday last, when voting took place for the chairman, vice-chairmen and Committee for the next session, which resulted as follows:—

Chairman.—Dr. E. W. Marchant.

Vice-chairmen.—Dr. E. Rosenberg, Mr. P. P. Wheelwright.

Committee.—Messrs. C. C. Aitchison, C. J. Beaver, K. Faye-Hansen, H. J. Hawkins, E. L. Hill, G. Layton, A. E. Mackenzie, E. M. Hollingsworth, B. Thomas, B. Welbourn, F. H. Whysall, Prof. Miles Walker.

Votes of thanks were accorded to the Vice-chairmen, Secretary, and Committee for their work during the session, also to the Council of the University for kindly granting the use of the Physical Laboratory for holding the meetings of the Section.

After the formal business of the meeting was concluded, Prof. E. Rutherford, of the Manchester University, gave a lecture on "The Electrical State of the Atmosphere." The lecture was illustrated by lantern slides and was listened to with great interest.

Prof. Marchant, in proposing a vote of thanks to the Chairman, stated that Mr. Day had suffered a relapse, and that it seemed certain he would not be able to resume his active duties for some time.

The report of the Committee states that the Section comprises 813 members, an increase of 23.

At a meeting of the Huddersfield Engineering Society on Thursday last week, Mr. J. E. Schofield (Bradford) read a paper on "Electricity in Textile Mills."

Institution of Electrical Engineers.—Examinations.—Regulations for the examination of candidates for Associate Membership have now been issued. Examination will be required on and after June 1st, 1913. In lieu of examination, candidates will be allowed to present a thesis, paper, or other contribution to electrical knowledge, but they will be liable to be examined orally thereon. The examinations will be held in London twice annually on two days (Friday and Saturday) about the end of April and end of October. Examinations may also be held at other centres, if the number of local entries warrants such arrangements.

Applications to enter for the examination must be made not later than March 1st for the April examination, and not later than September 1st for the October examination. The examination fee will be two guineas for the first entry, and one guinea for any subsequent entry. Fees will not be returned.

The subjects of examination will be as follows:—Part I: An English essay; or translation into English of passages in one of the following languages, to be selected by the candidate; French, German, Italian or Spanish. Applied mechanics; and either general elementary physics or chemistry. Part II: Two papers on one of the following subjects, to be selected by the candidate:—Electricity supply; electric lighting and power; electric traction; telegraphy; telephony; application of electricity to mines; electro-chemistry and electro-metallurgy; manufacture of electric machinery (including works management); design of electric machinery and apparatus. No detailed syllabus of the subjects of examination will be published.

Exemption from the whole of the examination is secured by any Engineering Degree of any University in the United Kingdom or in the British Dominions over seas; by Whitworth Scholarships, and by the Diplomas or Certificates in electrical engineering granted by the following bodies:—The City and Guilds Engineering College: City and Guilds of London Institute (Honours Grade); Faraday House; Finsbury Technical College (day course); King's College, London; University College, London; Heriot-Watt College, Edinburgh; Royal Technical College, Glasgow; Municipal School of Technology, Manchester; Armstrong College, Newcastle-upon-Tyne.

Candidates who have obtained a Science Degree from any University in the United Kingdom or the British Dominions will be exempted from Part I of the examination.

I.E.E. Paris Visit.—Particulars have now been issued regarding the Paris meeting, to be held on May 21st to 24th next, in conjunction with the Société Internationale des Electriciens. Members will leave London at 11 a.m. on Tuesday, May 20th, arriving in Paris at 6.45 p.m. On Wednesday morning the inaugural meeting will be held at the Conservatoire des Arts et Métiers, when there will be a discussion on the electrification of railways, or, alternatively, an inspection of the exhibits at the Conservatoire. In the afternoon there will be alternative visits to the generating stations of the Electricité de St. Denis and of the Triphasé at Asnières, and to the Sèvres porcelain factory. In the evening the Société Internationale will give a reception and banquet at the Palais d'Orsay.

On Thursday morning there will be a discussion on Long-distance Transmission of Electrical Energy by (*a*) Continuous Current, Thury System (paper by Mr. J. S. Highfield); (*b*) Three-phase Current (paper by M. Maurice Leblanc), and a number of alternative visits to places of interest. In the afternoon, M. Eiffel will hold a reception at the Eiffel Tower, and there will be an inspection of the wireless installation. An alternative visit has been arranged to the electrical installations of the Métropolitain, the Nord-Sud and the Compagnie des Omnibus.

On Friday morning, the discussion at the Conservatoire will be continued, and alternative visits will be arranged. In the afternoon there will be an excursion to Chantilly.

On Saturday morning, M. Claude will read a paper on "Lighting by Means of Vapour-Tube Lamps" (illustrated by experiments), and there will be a lecture by Commandant Ferrié on "Wireless Telegraphy." The rest of the day will be spent in visits to Versailles, the Aerodrome at Buc, and the Ouest-Etat Railway, returning to Paris by special electric train.

The cost, exclusive of hotel expenses, will be five guineas each.

Royal Society of Arts.—On Wednesday evening, a paper on "Electric Supply in London" was read by Mr. Frank Bailey, M.Inst.C.E., M.I.E.E., joint managing director, City of London Electric Lighting Co., Ltd. The chair was taken by Mr. A. A. Campbell Swinton.

Institution of Post Office Electrical Engineers.—A paper on "Telegraphic History," read before the above Institution last year by Mr. H. R. Kempe, has just been printed. It covers the period since the year 1837, in which Sir Charles Wheatstone, the pioneer of modern practical telegraphy, took out his first patent. As a former pupil of Wheatstone's, and the oldest representative of the Postal Telegraph Engineering Branch, the author was able to relate a series of extremely interesting reminiscences, and to illustrate his subject with numerous examples of apparatus and systems, tracing the development of the science through its earlier stages.

The Production Managers' Association.—The inaugural dinner of this Association was held on Tuesday night at the Holborn Restaurant. The subject of the evening was "Labour Problems," introduced by Mr. W. Gamble, managing director of Messrs. A. W. Penrose & Co., Ltd., who was in the chair.

Electricity Supply Rifle League.—A post match between teams representing Hackney Electric Rifle Club (Hackney Borough Council) and the Brompton and Kensington Rifle Club in the above League resulted in a win for the latter by 41 points. The scores were:—Hackney 520 (best score, Hilling 94); Brompton and Kensington 561 (Beale 97).

Appointments Vacant.—Meter superintendent (£104), meter tester and erector (30s.), jointer-wireman (32s.), arc lamp trimmer (27s.) and junior shift engineer (28s.), for the Guildford Electricity Supply Co., Ltd.; charge engineer, for the Ilford U.D.C. Electricity Works (£78); sub-station shift engineer, for the Bristol Corporation (30s.); switchboard attendant, for the Portsmouth Corporation (25s.); station assistant and mains engineer, for the City Electricity Works, Londonderry (£2); junior assistant electrical engineer for the Oldham Corporation (£80); tramways manager, for the Southport Corporation (£200). See our advertisement pages in this issue.

Football.—During the football season down to date, the Beeston Ericsson Club have played 26 matches, winning 19, while five were drawn and two lost. They scored 100 goals to 33. This is for all matches, League, Cup and friendly. The club won the Notts. Intermediate Cup, scoring 14 goals to 1, and they are runners-up in the Notts. Combination League. The League record is:—Played 17, won 11, drawn 4, and lost 2, scoring 58 goals against 19.

Association of Electrical Station Engineers.—A meeting was held on Friday last at Grimsby. Mr. A. Nuttall was in the chair, and the questions of increased salaries, six day week and certificates for qualified electrical engineers were discussed, after the reading of a letter from the hon. sec., replying to some queries on these points. The replies of the hon. secretary being considered satisfactory, the meeting passed a few resolutions with regard to future policy to be considered by the London Committee. It was suggested that the views of chief electrical engineers be ascertained with regard to the A.E.S.E. Mr. W. M. Fowler was elected delegate to attend the London conference, and it was decided to hold another meeting before the conference to instruct the delegate on matters which the Grimsby district wishes to lay before the conference.

Late Legal. — Battersea Borough Council *v.* County of London Electric Supply Co.—In the Chancery Division on Wednesday, April 9th, Mr. Justice Joyce heard a motion in this action for the purpose of obtaining a decision as to whether the defendants were entitled to lay electric mains through the streets of the plaintiff Council.

Mr. Hughes, K.C., and Mr. Meyer appeared for the plaintiffs, and Sir Alfred Cripps, K.C., and Mr. Tyldesley Jones for the defendants.

Mr. Hughes said that the real question was whether these defendants had the right to break up streets within the plaintiffs' area, and by the notice of motion the plaintiffs asked for an injunction to restrain the defendants from laying their mains in the Wandsworth Road, Nine Elms Road, Battersea Park Road, York Road or any other street or place within the Metropolitan Borough of Battersea. What the defendants wanted to do was to lay their mains along the main roads right through Battersea. They had already got provisional orders in respect of some districts.

Sir Alfred Cripps said they had yet to get the consent of the Board of Trade, but the question was whether the defendants had the right to lay the mains at all. Mr. Hughes said that if the defendants had the right, then in respect of any difference as to route or the way the mains should be laid, it was to be settled by the Board of Trade, but the only question was whether the defendants had any right to do it at all. If they had the right, then the further question would arise as to how the right should be exercised. That was to be settled by agreement with the local authority, and failing an agreement by an arbitrator appointed by the Board of Trade. The defendants had no power to do what was complained of under their provisional orders or the Confirmation Act, and the question was whether they had under a subsequent Act which related to various other metropolitan companies as well. The defendants had certain defined areas of supply.

Mr. Justice Joyce asked whether they claimed a monopoly in these areas.

Mr. Hughes thought not, but that did not matter for the purposes of the Act.

Sir Alfred said that in some districts there were one or two companies supplying.

Mr. Hughes said the defendants had a large area of supply on the south of the Thames, which included Wandsworth, Camberwell and north of that to the Southwark boundary. Wandsworth was detached from the other two by a short intervening space of about a quarter of a mile. They had an area on the north side of the Thames with a generating station at Clerkenwell. They had also a generating station at Wandsworth, just where the Wandle flowed into the Thames. They had no right of supply in Battersea, but what they were proposing to do was to lay a main along the high road through the Borough of Battersea, and the plaintiffs, as the highway authority, objected to their breaking up the streets. It was not necessary for him to point out that the importance of the question was very great. This main street was honeycombed with pipes, and if additional powers were given to any power company to break up the street it would be a very serious matter indeed. There were already there electric light companies' wires, telegraph and telephone wires, sewers, water pipes and what not. If the defendants, therefore, had not the right they claimed, it was very important for the Council to prevent them from doing what they were proposing to do. The point in the case was that the Wandsworth area was already connected with Camberwell area at a point close to West Norwood and that they desired further to connect those two areas was the key to the whole matter. Recently, under powers given by the County of London Electric Supply Act, of 1908, the defendants had connected up their south

areas with the generating station at Clerkenwell by cables carried over London Bridge. The whole of their areas were, therefore, now connected together, and each area was connected with both of their generating stations. What they now wanted to do was to have this further connection, which they did not allege was necessary, but only alleged that it was convenient. It was most important to bear in mind that all their areas were already connected, and that both generating stations were connected with all the areas, as his case would be that they were only entitled to necessary connections. The Act of 1908 for the first time enabled the suppliers of electrical energy in the Metropolitan area to enter into agreements with one another, and in order to enable such agreements to be carried out, power was given to connect one area with another, and also to connect generating stations with outlying areas. In their own areas the method of carrying it out was to be governed by each company's own Acts, coupled with the general sections of the Electric Lighting Act of 1882, and special sections of the Act of 1899, and where the mains were laid outside the area the right was to be subject to the provisions of those Acts and agreement with the local authority interested. Failing agreement with the local authority, the matter was to be submitted to an arbitrator appointed by the Board of Trade. The route which defendants were proposing to follow was the most inconvenient possible, because it went along the main street of Battersea from one end to the other. That would, of course, be a matter for the Board of Trade, but what the defendants wanted was a second or alternative connection between their Wandsworth and Southwark areas, and that the plaintiffs contended they were not entitled to. If they were entitled to more than one, then counsel supposed they might have three, four, five, or, in fact, any number they chose.

His Lordship asked when the existing connection was made.

Sir Alfred said about 16 years ago by agreement with the local authority, but it was outside Battersea.

Mr. Hughes submitted that the Act did not give them any power except to make a connection where they had not got it already.

Mr. Justice Joyce: You admit that but for this existing connection the company would be entitled to do what was proposed.

Mr. Hughes thought that probably they would. If they were not connected, he said, they would probably be entitled to make a connection. The section, however, seemed to be carefully limited. The words were "to make a connection," and he contended that that meant to make one and one only. If the plaintiffs' contention was right they might make any number of connections they liked. They said this proposed connection was convenient, but they did not say it was a necessity.

His Lordship: What order do the plaintiffs ask for?

Mr. Hughes said that they wanted a declaration that under the section the defendants were not entitled to make the proposed connection.

His Lordship said he could not do that on an interlocutory motion. He might grant an injunction restraining the defendants from making any connection, but could not grant an injunction to restrain the breaking up of the roads.

Mr. Hughes said an injunction to restrain the making of the connection would satisfy them, and, of course, so far as they were concerned, it would be confined to Battersea.

Sir Alfred said that, assuming the Court was against him, which he did not anticipate, he would offer every assistance for getting the declaration or injunction in the proper form.

Mr. Hughes said that if the plaintiffs were right, they could break up every street in Battersea.

Mr. Justice Joyce said no doubt the Board of Trade would have something to say to that. Without calling upon counsel for the defendants, his Lordship dismissed the motion. He was not impressed, he said, with the arguments of the plaintiff Council, and he did not see why the company should not be entitled to connect now two or more of their areas merely because they had some 16 years ago managed to get a connection which was more or less convenient. It might, or might not, be sufficient, and it might be either in good or bad repair. There were no words in the section which said the company was not to make a connection in places where they had one before the passing of the Act, and he could not grant an interim injunction. The motion must, therefore, be refused, and the costs of the motion would be costs in the action.

Sir Alfred hoped that, if the Council had any idea of proceeding to appeal, they would press it on.

Mr. Hughes thought his clients would probably do so.

His Lordship said the sooner the question was settled the better.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The staff of the Dundee Corporation electricity department gave a dinner at the Queen's Hotel to Mr. H. Richardson, in honour of his tenth anniversary as engineer and manager. Bailie J. M. Nairn, the present chairman, and Bailie W. Don, ex-chairman of the Electricity Committee, were present as guests, and both the bailies congratulated Mr. Richardson on his able management, also upon the remarkable success of the department within the last decade, and commented on the close friendship that existed between the manager and the staff. In reply, Mr. Richardson spoke of the encouragement he had received from both gentlemen, and also thanked the staff for their loyalty to the department, especially the older members who were with him in the early days. After dinner a most enjoyable programme was sustained.

The Accrington Electricity Committee has advanced the salary of Mr. H. Pilling, tramways manager, from £200 to £225 per annum, with a further increase of £25 next year; and that of Mr. A. W. Clegg, electrical engineer's assistant, from £200 to £225 per annum, with a further increase of £25 next year. Mr. H. Gray, electrical engineer, is to be paid £50 for overtime and extra services in connection with the recent extensions at the electricity works.

Mr. C. S. Taylor has resigned the post of deputy engineer and manager to the Hankow Light and Power Co., and has accepted an appointment as a sub-station and power engineer to the Shanghai Municipal Council's electricity department.

Mr. H. W. Reeks (formerly of London) has resigned his position as switchboard attendant to the Mersey Power Co., Ltd., at Runcorn, having been appointed to a similar position under the London County Council.

The Committee of the Worthing T.C. has increased the salary of Mr. C. Broadhurst, assistant electrical engineer, from £160 to £170 per annum.

The Carlisle Electricity Committee on the 4th inst. selected Mr. Frederick Walter Purse, of Watford, for appointment as electrical engineer, at Carlisle, at a salary of £500 per annum. There were 148 applicants.

Tramway Officials.—The Birkenhead T.C., on April 2nd, confirmed the recommendation of the Tramways Committee, to increase the salary of Mr. Wyld, manager and electrical engineer, from £600 to £650 per annum. An amendment that the increase be not granted was rejected by 21 votes to 9.

General.—Mr. Thos. B. L. Newstead has joined the engineering staff of Messrs. Marconi's Wireless Telegraph Co., Ltd as assistant in the estimating department at Marconi House, Strand, W.C. He was previously for over three years with the Westinghouse Cooper-Hewitt Co., Ltd., as engineer-in-charge of their factory at 151-152, Great Saffron Hill, E.C., and upon leaving them recently was presented with a silver tea-kettle and cut-glass claret jug from the office staff and employés, together with an expression of cordial wishes for his future success.

Mr. Wm. Baxter has resigned his appointment with Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne, and opened an office at 90, Pilgrim Street, Newcastle-on-Tyne, as an agent. He will represent Messrs. Daniel Adamson & Co., Dukinfield, for turbines, boilers, pumps, &c.; Messrs. Eckstein, Heap & Co., Ltd., Manchester, for switchgear; Messrs. Newton Bros., Derby, for motors, dynamos, gas engines, &c.; also the St. Helens Cable and Rubber Co., Warrington, for cab-tire sheathed and other cables. Before leaving Messrs. A. Reyrolle & Co.'s works he was presented by Mr. Reyrolle with a handsome filing cabinet, which was subscribed for by the members of the office and works staff.

The marriage took place at the Church of St. Peter-Advincula, Coggeshall, Essex, on April 3rd, of Mr. C. Sandys Ball, A.M.I.E.E., only son of the late of Mr. Chas. Ball, of St. Leonards-on-Sea, Hastings, and who is a director of Messrs. Brown & Green, Ltd., electrical and general engineers, of Windsor Street, Luton, and Miss Mary Bright, second daughter of the late Mr. Wm. Bright and of Mrs. Bright, of Cromwell House, Coggeshall.

The telephone staff at Chesterfield have presented a tea service to Mr. A. B. Impey, assistant manager for the district, on his marriage.

Mr. Philipp Laubach has resigned his position as manager of the switchgear department of the Electrical Engineering and Equipment Co., Ltd., in order to join the firm of Mr. J. A. Law, chartered patent agent, 331, Birkbeck Bank Chambers, Holborn, W.C.

Mr. Wm. Benjamin Pinching, electrical engineer, was on Monday elected on to the Southgate U.D.C. for the Winchmore Hill Ward.

Obituary.—Mr. James Tangye.—We regret to record the death of Mr. James Tangye, one of the founders of the well-known firm of Tangyes, Ltd. He was born in 1825, and was the eldest of the Tangye family of nine. He died on 4th inst., at Illogan, near Redruth, Cornwall.

Prof. Adolf Slaby.—The *Times* publishes from its Berlin correspondent, a report stating that Prof. Adolf Slaby, of the Slaby-Arco wireless telegraph system, died at Charlottenburg on Sunday last at the age of 63. He received a second paralytic stroke a fortnight previously, and never recovered consciousness. Our contemporary states that from 1884 to 1902 the deceased professor was director of the electrical laboratory at the Technische Hochschule, and there began the experiments which led to the perfection of the "Telefunken" system. He attended Mr. Marconi's experiments in England in the year 1897. The Emperor William gave him frequent encouragement and support. In the Royal gardens, on the banks of the Havel, he worked the whole of the summer of 1897, sometimes 10 hours a day attempting to establish wireless communication between the Pfauen Island, in Wannsee and the Pfingstberg. In October of that year he established wireless connection between two captive balloons at a distance of 21 km.

CITY NOTES.

Brentford Electric Supply Co., Ltd.

The annual meeting of this company was held at the office of the company, 16, Stratford Place, W., on Tuesday last, Mr. F. Leverton Harris presiding. The following report of the proceedings has been received :—

The Secretary, Mr. E. Cunliffe Owen, having read the notice convening the meeting, the Chairman stated that of the authorised capital of £10,000, 3,757 shares had been issued. During the year £3,656 had been expended on capital account in laying a system of distributing mains throughout the area of supply and in providing house services and meters. With regard to the revenue account £507 had been paid to the Metropolitan Electric Supply Co., Ltd., under the bulk supply agreement for purchase of current; repairs had cost £19, and management expenses and general establishment and other charges £181. The sale of current had brought in £768 and other receipts £51, the financial result being a balance carried to net revenue account of £112, which the directors recommend should be carried forward. He thought the shareholders would consider this a satisfactory result for the first year's working. On December 31st last the number of consumers was 57, their requirements amounting to 168·5 KW., 96·2 KW. being for power. The maximum demand during the first half of the year was 51 KW., and during the second half this had risen to 85 KW. He referred to the prospects of the present year as being very satisfactory, the number of new consumers showing a steady increase. The accounts were adopted.

Lancashire Dynamo and Motor Co., Ltd.

The directors in their report for the year ended December 31st, 1912, state that, after providing for debenture and bank interest and charging full depreciation, the accounts show a profit for the year of £15,150. Adding the sum of £1,990 carried from the previous year, there is a disposable balance of £17,140, which it is proposed to appropriate as follows :—Dividend on preference shares for the year at the rate of 5½ per cent. per annum, less tax, £2,434 ; interim dividend on the ordinary shares at the rate of 5 per cent. per annum, free of tax, paid October 1st, 1912, £2,125 ; final dividend on the ordinary shares at the rate of 10 per cent. per annum, making 7½ per cent. for the year, free of tax, £4,250 ; directors' fees, £700 ; to reserve account, £6,000 ; carry forward, £1,631. In view of the coal strike and disturbed labour conditions, which have restricted the output of the year, the results are considered satisfactory. The orders on hand are at better prices than last year, and if there are no labour disturbances the result for 1913 should be quite equal to, if not better than, the past year.

The Manchester *Daily Dispatch* publishes the following figures showing three years' comparisons as follow, after deduction of debenture and loan interest and depreciation :—

	1910.	1911.	1912.
Profits	£5,208	£10,009	£15,150
Preference dividend	2,434	2,434	2,434
	2,774	7,575	12,716
Directors' fees	700	700	700
	2,074	6,875	12,016
Opening foreign agencies	1,971	—	—
	103	6,875	12,016
Ordinary dividend	—	5,100	6,375
	103	1,775	5,641
Reserve	—	—	6,000
	103	1,775	—359
Brought forward	112	215	1,990
Carried forward	215	1,990	1,631

Owing to exceptional circumstances, including the development of new types and opening of foreign agencies, the company for the year 1910 paid no dividend on its ordinary shares, for the first time since its formation, 14 years ago.

It is stated that the company is issuing the balance of the unissued ordinary capital, amounting to £15,000, which will bring the total ordinary capital up to £100,000.

We congratulate the company upon the excellent improvement shown in the above figures for 1912.

Stock Exchange Notices. — The Committee have ordered the undermentioned securities to be quoted in the Official List :—

Birmingham District Power and Traction Co., Ltd.—£51,458 additional 4½ per cent. first debenture stock.

Consolidated Cities Light, Power and Traction Co.—$4,000,000 first lien 5 per cent gold bonds of $500 each (Nos. 1 to 8,000), in lieu of the script.

Consolidated Diesel Engine Manufacturers, Ltd.—67,470 shares of £1 each, fully paid (Nos. 527,077 to 594,546).

Pacific Power and Light Co.—$5,904,000 5 per cent. first and refunding mortgage 20-year gold bonds, international series (Nos. 1 to 5,904), for $1,000 each.

Canadian General Electric Co.—The report states that the year to December 31st was one of marked expansion. The accounts, according to the *Financier*, show a profit of $2,011,700, from which have been written off for depreciation $456,400, and for interest on borrowed capital $158,900, leaving $1,396,500. Out of this the usual 7 per cent. dividend has been paid on the preferred capital, and 7 per cent. on the common shares, together with a bonus of 1 per cent., while $700,000 has been added to the reserve fund, giving a total of $2,360,500 at credit of this account.

North of Scotland Electric Light and Power Co., Ltd.

The directors' report for 1912 states that satisfactory progress has been made during the year. The gross profit, including £1,653 brought forward, is £8,048, and after meeting interest paid on debentures and loans, amounting to £2,799, and writing off £28, part cost of street lighting alterations, and 10s. loss on meters transferred, there remains a net profit of £5,221. The directors recommend a dividend at the rate of 2 per cent. for the year, which will absorb £1,000, that £2,000 be placed to renewal reserve account, and that the balance, £2,221, be carried forward.

	Montrose.	Brechin.	Inverness.
Units generated	287,479	202,104	628,604
Units sold—Public lamps	50,953	32,878	—
Private consumers by meter	176,454	116,834	485,270
Total sold	227,407	149,712	485,270
Used on works	46,253	40,552	100,120
Total accounted for	273,660	190,264	585,390
Not accounted for	13,813	11,840	43,214
Total maximum supply demanded	178 KW.	110 KW.	327 KW.
Lamps connected, January 1st	28,882	18,990	29,000
Lamps connected, December 31st	24,765	19,907	32,810

Prospectus.—*International Light and Power Co., Ltd.*—This week there has been offered for sale $1,000,000 6 per cent. cumulative preference stock, in shares of $100 (£20 10s. 8d.), with a bonus of $60 in common stock, at £18 per share. The list was to close yesterday. The company has acquired the stock and debentures of companies owning electric light and gas plants and distribution systems in Caracas, Venezuela, and Parana, in the Province of Entre Rios, Argentina, together with £30,000 for working capital. The Venezuela Electric Light Co. is registered in Canada, and its $900,000 ordinary capital and $900,000 in 5 per cent. debentures are all held by the International Co. It serves Caracas, which has a population of 80,000, with electric supply, and purchases power from a hydraulic company, so that further generating stations beyond those now possessed are not at present needed. The Parana Co.'s $500,000 shares and $295,000 debentures are held by the International Co. Parana has a population of 42,000, and the company has a 640-KW. generating station operated by producer gas, also a gas supply plant. The receipts and expenses of both undertakings are quoted in the prospectus, and a report is also given therein by Messrs. J. G. White & Co., Ltd., who will act as managers of the properties. Mr. W. C. Burton and Mr. A. N. Connett, directors of that company, are on the board of the International. The International Co. is negotiating for further similar properties, and has entered into a conditional contract for the purchase of the shares and debentures of one other electric lighting undertaking. The London offices are at 9, Cloak Lane, E.C.

Milford-on-Sea Electric Light Co., Ltd.—Dr. V. D. Harris (chairman) presided on March 29th over the annual meeting of this company. The directors reported that the progress during the year had been satisfactory, and the amount of revenue showed an increase from £808 to £906. After charging all working expenses, writing £25 off preliminary expenses, and placing £149 aside for depreciation of plant, there remained a net profit of £353, which had been carried to net revenue account. This had been charged with the interest on debentures and depreciation on investment, and with the balance brought forward from last year, there remained £290, out of which the directors recommended a dividend of 5 per cent. for the year on the ordinary shares, the balance being carried forward. The report was adopted.

Reading Electric Supply Co., Ltd.—The directors report a net revenue for 1912, after setting aside £3,500 for depreciation, and including £420 brought forward, of £7,363. They recommend a dividend of 3½ per cent. £517 is to be carried forward.

Sao Paulo Tramway, Light and Power Co.—The directors have declared a dividend of 2½ per cent.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent.

United River Plate Telephone Co., Ltd.—The directors have declared a dividend on the ordinary share capital for the nine months ended December 31st at the rate of 8 per cent. per annum, free of income-tax ; £5,804 is carried forward.

Anglo-Argentine Tramways Co., Ltd.—The directors have declared a final dividend of 4¼ per cent. on the £2,500,000 ordinary share capital for the half-year to December 31st, less income-tax, making 8½ per cent. for the year. £135,000 is placed to depreciation, renewals funds, &c., and £9,253 is carried forward. The dividend for 1911 was only 7¼ per cent.

Electrolytic Alkali Co., Ltd.—According to yesterday's papers, a notice was issued by the Electrolytic Alkali Co., Middlewich, summoning an extraordinary general meeting to pass a resolution voluntarily winding up the company's business. The year's accounts, which accompany the notice, show a debit balance of £11,894. The directors state that the negotiations for power schemes, which would have placed the company in a sound position, have failed, and they feel that until modern power plant has been installed they can hold out no prospect of the company earning a profit. The company's issued capital is £301,869.

Direct United States Cables Co., Ltd.—Final dividend, 2s. per share, less income-tax, payable 30th inst., making with the three interim dividends already paid a total distribution of 4 per cent. for the year ended March, 1913. The transfer books will be closed from April 15th to 29th.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, April 9th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	"	22/-	..
a " Oxalic	per lb.	2¾d.	..
a " Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	"	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	"	£6 5	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£17 10	..
a Copper Sulphate	"	£23 15	..
a Lead, Nitrate	"	£29 10	..
a " White Sugar	"	£27 10	..
a " Peroxide	"	£33	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (86/90 %)	per ton	£23 10	..
a " Chlorate	per lb.	3½d.	..
a " Perchlorate	"	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	"	7½d.	..
a Shellac	per cwt.	80/-	5/- dec.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	"	£6 10	..
a " Recovered	"	£5 10	..
a " Lump	"	£5	..
a Soda, Caustic (white 70/72 %)	"	£10 5	..
a " Chlorate	per lb.	3½d.	..
a " Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£95	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	£112	..
b " Sheet, in ton lots	"	£120	..
p Babbitt's metal ingots	"	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8½d.	½d. inc.
c " Tube (brazed)	"	10½d.	½d. inc.
c " " (solid drawn)	"	9d.	½d. inc.
c " Wire, basis	"	8½d.	½d. inc.
c Copper Tubes (brazed)	"	11½d.	½d. inc.
c " " (solid drawn)	"	10½d.	½d. inc.
g " Bars (best selected)	per ton	£84	£1 inc.
g " Sheet	"	£84	£1 inc.
g " Rod	"	£84	£1 inc.
d " (Electrolytic) Bars	"	£69 15	..
d " " Sheets	"	£86 10	..
d " " Rods	"	£75	..
d " " H.C. Wire	per lb.	9¾d.	..
f Ebonite Rod	"	4/6	9d. dec.
f " Sheet	"	4/-	9d. dec.
n German Silver Wire	"	1/10	..
h Gutta-percha, fine	"	7/- to 8/-	..
h India-rubber, Para fine	"	3/5	5½d. dec.
i Iron Pig (Cleveland warrants)	per ton	65/6	1d. inc.
l " Wire, galv. No. 8, P.O. qual.	"	£14	..
g Lead, English Pig	"	£17 15	£1. inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	..
c Mica (in original cases) small	per lb.	6d. to 8s.	..
c " " " medium	"	3/6 to 6/-	..
c " " " large	"	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	"	3/6 to 4/6 nom.	..
p Phosphor Bronze, plain castings	"	1/2 to 1/3½	..
p " " rolled bars & rods	"	1/2	..
p " " rolled strip & sheet	"	1/2½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	"	£232 to £234	£16 inc.
n " Wire, Nos. 1 to 16	per lb.	2/7	..
p White Anti-friction Metals	per ton	£45 to £228	..
k Zinc, Sh's (Vieille Montagne bnd.)	"	£28 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

The Balkans business seems to get more oppressive instead of less We seem to have been standing on the eve of peace over and over again, but something has intervened at the last minute to intercept the conclusion of the war, and markets are in a sensitive and nervous condition, not knowing from day to day what will be the next turns of events. On Monday, matters seemed to be drifting once more in the direction of a general European *impasse*, but on Tuesday a partial recovery followed rumours of the Servians having abandoned their intention of taking Scutari.

Every now and then comes one of these little flashes of brightness, to be dimmed, as a rule, within all too short a time. Fresh borrowing is no more than checked, for new issues of substantial amount appear with unpleasant frequency. Fortunately, the acute stringency in the money market stands somewhat relaxed, but the expectations that the Bank of England would this week reduce its rate are at the moment considered nebulous, in view of the unsettlement of the outlook abroad.

Prices had to give way everywhere in the Stock Exchange where a bull account of any sort existed, and the Home Railway market has already suffered severely. The Undergrounds proved incapable of resisting the tendency, and Metropolitans shed 1½ after their substantial rise of last week, while the Surplus Lands stock fell 1, and the two Preference issues both lost a point. Districts went back 1¼. Underground Electric shares fell ⅛ and the Income Bonds ½. City and South London 1891 Preference went back to 99½. The spurt in East Londons, which carried up the price of the stock to 10⅜, became exhausted under the pressure of the bulls to realise their profits, and the price has fallen back to 9½, notwithstanding the electrification. North Londons at 93½ are 2 down. Traction issues remain fairly steady, but British Electric 7 per cent. Preferred is again ½ lower. Yorkshire 6 per cent. Preference shares at 3¼ show ⅛ rise.

In English Electricity Supply shares, the only rises are one of $\frac{3}{16}$ in Edmundsons' 6 per cent. Non-Cumulative Preference, and another of ⅛ in Bournemouth and Poole Second Preference. London Preference are the turn easier, but Westminsters and Bromptons have retained their advances. The prior charge issues are firm, a point rise in Midland Electric 4½ per cent. Debenture stock being the only quotable change.

After the rise in Marconis last week there has been some reaction, both Ordinary and Preference going back. Canadians eased off to 16s., Americans to 1⅛, and Spanish to 18s. 9d. The dealings of the three Cabinet Ministers remain the subject of the liveliest interest in the Stock Exchange, where members, while disclaiming political bias, have only one opinion as to the discretion shown by responsible members of the Government in investing their money at 100 per cent. premium in shares of a company like the American Marconi.

National Telephone Deferred has fallen to 18¾, some of the previous holders evidently getting timid with regard to the probable payment that will be made in respect of this stock. Great Northern Telegraphs have again mounted, putting on another 10s. on top of the rise of 50s. which took place in them last week—due, of course, to the increase in the dividend. The hardening process in Eastern Telegraph Ordinary is once more noticeable, and Globes have risen ½. New York Telephone bonds continue to be bought by the investor, and the quotations have again reached par. Improvements have been scored by Monte Video Telephones and Oriental Telephones. Mackay Common and Preference picked up in response to New York advices, the American Railroad market being so firm as to lead Industrials in its train. American Telephone stock and bonds are both better.

The Latin-Canadian market is comparatively hard, considering the dullness ruling elsewhere. Mexico Trams and Mexican Light and Power Common shares have gone back, which is not very surprising, seeing that they both had big improvements a week ago. The bonds of both companies, however, continue to advance, and those of the Mexico Tramways Company are in demand from the Provinces as well as London. British Columbia Electric Deferred stock rose 2 on the day that the lists closed for sending in applications for the new shares offered by the Company. These latter had been quoted at 1s. 6d-2s. 6d. premium for cash, and an incessant stream of selling took place during the past fortnight by holders who elected to accept their profit rather than to take up the shares and wait for something more substantial. That the new shares will improve seems virtually assured, unless anything very unexpected should happen. British Columbia is going ahead rapidly, but, as is the case with many other parts of Canada, the stringency of the money markets of the world has made itself felt even as far West as this.

Shawinigan Water lost a point, though the 4½ per cent. Debenture stock is ½ higher. Brazil Tractions, after touching 102, went back to 100, the price being swayed considerably by the tenour of the foreign political news. Canadian General Electric Common strengthened to 117. Outside this group the market is quietly dull. Buenos Ayres Trams lost ⅛, and Bombay Electric Preference went back to 11⅛, a fall of ¼. No changes have occurred in the Anglo-Argentine quintet.

British Westinghouse Preference shares and Debenture stock are both better, and British Aluminium 5 per cent. Prior Lien Debentures put on another point, attention being directed to them by reason of the soundness of the security offered by the stock. Henleys are a little lower. Armament shares, after being strong, went back again. Armstrongs rose smartly upon the decision of the board to give proprietors one new share for every four old at present held, but part of the rise was lost later, when it was announced that the board intended to apply for powers to issue a couple of million pounds new capital in 5 per cent. Preference shares. Vickers, too, have been a little erratic leaning somewhat to the dull side. Babcocks at $3\frac{5}{16}$ have failed to recover from their small shrinkage of a week ago. The rubber share market enjoyed a brief spell of strength upon the conclusion of the fortnightly auctions, but this evaporated, and prices have once more fallen back into weakness, with buyers of the shares distinctly scarce. There is now a fairly big bear account in many of the leading rubber issues, so that if the price of the commodity were to take an upward turn, there is a ready-made element of strength. Still, at the moment, there does not seem much chance of a sustained revival occurring in raw rubber.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations April 8th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	6	11/16 – 1 1/16 xd	..	5 18 5
Do. 4½ % Pref.	10	4½	4½	8¼ – 9½	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 – 10½	+ ⅛	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	96 – 98	..	4 11 10
Brompton & Kensington, Ord.	5	10	10	8⅞ – 9⅛ xd	..	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8⅜ – 8⅝ xd	..	8 18 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	95 – 98	..	4 1 8
Charing Cross, West End & City	5	5	5†	4⅞ – 4⅞	..	5 2 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ – 4½	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ – 4⅛	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	91½ – 93½	..	4 5 7
Chelsea, Ord.	5	5	4†	4½ – 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	96 – 99	..	4 10 11
City of London, Ord.	10	8	9	16 – 17½	..	5 6 8
Do. 6 % Cum. Pref.	10	6	6	12 – 13	..	4 10 7
Do. 5 % Deb.	Stock	5	5	116 –120	..	4 3 4
Do. 4½ % Second Deb.	100	4½	4½	100 –102	..	4 8 8
County of London, Ord.	10	6	6	10⅞ – 11¼	..	5 6 8
Do. 6 % Pref.	10	6	6	11¼ – 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	104 –106	..	4 4 11
Do. 4½ % Second Deb.	Stock	4½	4½	99 –102	..	4 8 8
Edmundson's, Ord.	£3	Nil	..	1/16 – 1/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4¼ – 4⅝	..	..
Do. 6% Non-Cum. Pref.	5	..	..	1⅜ – 1⅞	+ 1/16	..
Do. 4½ % First Mort. Deb.	100	4½	4½	81 – 84	..	5 7 2
Folkestone	5	6	6	4½ – 5 xd	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ – 5 xd	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	90 – 92	..	4 17 10
Hove	5	9	8†	7⅞ – 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	8†	7⅞ – 8	..	5 12 6
Do. 4 % Deb.	Stock	4	4	90 – 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 – 80	..	5 12 6
London Electric, Ord.	3	2½	..	1⅜ – 1⅝	..	4 0 0
Do. 6 % Pref.	5	6	6	4⅜ – 5⅛	– ⅛	5 17 1
Do. 4 % First Mort. Deb.	Stock	4	4	91 – 94	..	4 5 1
Metropolitan	5	4	4†	3⅜ – 3⅝ xd	..	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ – 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 –100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	84 – 86	..	4 1 5
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	99 – 102	+1	4 8 3
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4¼ – 4¾ xd	..	5 5 3
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99½ –102½	..	4 17 7
Notting Hill, 5 % Non-Cum. Pref.	10	6	6	9⅞ – 10⅞	..	5 11 7
Oxford	5	7½	6†	5⅞ – 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10†	8¾ – 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6½ – 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	84 – 87	..	4 0 6
Smithfield Markets, Ord.	5	2	2	⅞ – 1⅛	..	..
South London, Ord.	4	6	6	2¾ – 3⅜ xd	..	7 7 8
Do. 5 % First Mort. Deb.	100	5	5	97 –100	..	5 0 0
South Metropolitan, 7 % Pref.	1	7	7	1 1/16 – 1 1/16	..	5 17 11
Do. 4½ % First Deb. Stock	100	4½	4½	94 – 97 xd	..	4 11 3
Urban, Ord.	£3	Nil	..	⅛ – ¼	..	..
Do. 5 % Cum. Pref.	5	2	‡	2⅜ – 3¼	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	83 – 86 xd	..	5 2 3
Westminster, Ord.	5	10	10	8½ – 9	..	5 11 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ – 5⅛	..	4 .. 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 – 5⅛	..	5 14 3
Calcutta, Ord.	5	8½	7†	6⅜ – 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅜ – 5⅛	..	4 17 7
Calgary Power, 1st Mort. Bds.	100	5	5	93 – 95	..	5 5 8
Canadian Gen. El. Com.	$100	7	7	115 –119 xd	+2	5 17 8
Do. 7 % Pref.	$100	7	7	119 –123 xd	..	5 18 10
Cordoba Lt., Power and T., Ord.	1	3		1/16 – ⅛	..	5 14 3
Do. 5 % Deb.	100	5	5	£3½ – 96½ xd	..	5 3 8
Elec. Lt. and P. of Cochabamba, 7 % Bonds	100	6	6	93 – 95	..	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	90 – 93	..	5 7 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92½ – 94½	– ½	5 5 10
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 – 1/16	..	Nil
Do. 6 % Pref.	1	6	6	⅛ – ⅛	..	9 15 2
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 –103	– ½	4 17 1
Madras, Ord.	5	Nil	..	1⅜ – 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 –104	..	4 16 2
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	82 – 85	+1	5 17 8
Mexican Lt. & Power, Common	$100	4	4†	78 – 81	–1	4 18 9
Do. 7 % Cum. Pref.	$100	7	7	104 –107	+1	6 10 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	92½ – 94½	+ ½	5 5 10
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	83½ – 86½	+ ½	5 15 7
Montreal, Lt., H. and Power	$100	8	9†	225 –230	..	3 18 3
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	10 –20	..	..
River Plate, Ord.	Stock	10	..	217 –227	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	105 –110	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	100 –102	..	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 –100 xd	..	4 10 0
Shawinigan Water, Capital	$100	5	5	139 –144	–1	3 9 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 –109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	101½ –103½	+ ½	4 7 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	97½ – 99½	..	4 10 6
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91 – 94	..	5 6 5
Victoria Falls Power, Pref.	1	11 7/16d.	17 7/16d.	1/16 – 1/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 – 108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	7 – 7½	..	6 0 0
Do. 5 % Deb. Red.	Stock	5	5	97 – 99	..	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	134 –136 xd	+1	5 17 8
Do. Collat. Trust	$1000	4	4	91 – 93	+1	4 6 0
Anglo-American Telegraph	Stock	8	8	61 – 68	..	4 8 3
Do. 6 % Pref.	Do.	6	6	111½ –112¼	..	5 6 8
Do. Def.	Do.	80/-	..	24⅜ – 24⅝	..	6 1 10
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	99½ –101½	..	4 18 6
Chili Telephone	5	7	8	7 1/16 – 7 1/16	..	5 1 1
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	80 – 82 xd	..	4 17 7
Cuba Telegraph	10	6	6†	8 – 9	..	6 9 9
Do. 10 % Pref.	10	10	10	16 – 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	3½ – 3⅝ xd	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6½ – 7 xd	..	7 2 10
Direct United States Cable	10	5	4	6⅜ – 7⅛	..	5 10 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 –101	..	4 9 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	126 –128	+ ½	5 1 5
Do. 8½ % Pref. Stock	Do.	8½	8½	78½ – 80½	..	4 6 11
Do. 4 % Mort. Deb.	Do.	4	4	95 – 97	..	4 2 6
Eastern Extension	10	7	7†	12⅝ – 13⅜	..	5 4 8
Do. 4 % Deb.	Stock	4	4	96 – 97	..	4 2 6
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 –101	..	3 19 8
Globe Telegraph and Trust	10	6	6†	10⅜ – 11½	+ ⅛	5 6 8
Do. 6 % Pref.	10	6	6	12½ – 13	..	4 12 4
Great Northern Telegraph	10	18	20	32 – 34	+ ½	5 17 8
Indo-European Telegraph	25	13	5†	58 – 60	..	5 8 4
Mackay Companies Common	100	5	5	83 – 86	+3⅛	5 16 3
Do. 4 % Cum. Pref.	$100	4	4	69 – 72	+2⅛	5 11 1
Marconi's Wireless Telegraph	1	20	..	4⅛ – 4⅜	– 1/16	4 11 6
Do. 7 % Cum. Partic. Pref.	1	17	..	8⅜ – 8½	– ⅛	4 10 8
Monte Video Telephone, Ord.	1	6	6†	1 – 1⅛	+ 1/16	5 6 8
Do. 5 % Pref.	1	5	5	⅜ – ½	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99½ –100½	+ ½	4 .9 9
Oriental Telep. and Elec.	1	8	6†	1⅞ – 2	+ ⅛	4 0 0
Do. 6 % Cum. Pref.	1	6	6	1⅜ – 1⅝	..	4 18 6
Do. 4 % Red. Deb.	Stock	4	4	88 – 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97½ – 99½	..	4 0 5
Reuter's	10	10	10†	11½ – 11⅝	..	8 10 2
Do. New Shares	10	..	..	10 13/16 –11 1/16	..	..
Submarine Cables Trust	Cert.	6	6	127 –130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96 – 98	..	4 11 10
United River Plate Telephone	5	8	..	7⅜ – 7⅝	..	5 4 11
Do. 5 % Cum. Pref.	5	5	5	5⅛ – 5⅜	..	4 9 0
West Coast of America	2½	2½	..	1¼ – 1⅜	..	4 3 4
Do. 4 % Debs., 1 to 500 guar. by Brss. Sub Tel.	100	4	4	95 – 98	..	4 1 8
West India and Panama Teleg.	10	2½	1½†	3 1/16 – 3 1/16	..	..
Do. 6 % Cum. 1st Pref.	10	6	6	10 – 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅜ – 10	..	6 0 0
Do. 5 % Debs.	100	5	5	101 –103	..	4 17 1
Western Telegraph, Ltd.	10	7	7†	13 – 13½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	95 – 97	..	4 2 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	97½ –100½	..	4 10 0

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations April 8th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	1 1/16 — 1 3/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	74 — 79 xd	..	5 14 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	9 — 11	..	..
Do. Do. Deferred	100	..	..	3 1/16 — 5 1/16	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	85 1/16 — 88 1/16	..	6 15 7
Do. 7 % Non-Cum. Pr'f.	100	..	..	34 — 37	— 1/2	..
Do. 5 % Perp. Deb.	100	5	5	88 1/16 — 92 1/16 xd	..	5 8 1
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 79	..	5 13 11
Central London Railway, Ord.	100	8	8	79 — 81	..	†4 18 9
Do. Pref.	100	4	4	83 — 85	..	†4 14 2
Do. Def.	100	2	2	78 — 80	..	†5 0 0
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
City & S. London, 5 % Pref., 1891	100	5	5	98 —101	—1	4 19 0
Do. Do. 1896	100	5	5	99 —102	..	4 18 0
Do. Do. 1901	100	5	5	97 —100	..	5 0 0
Do. Do. 1908	100	5	5	95 — 98	..	5 2 0
Do. 4 % Deb.	100	4	4	95 — 97	..	4 2 6
Dublin United Trams, 6 % Pref.	10	6	6	11 1/16 — 12 1/16	..	4 18 0
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2 1/16 — 2 3/16	..	Nil
Hastings Trams, 6 % Pref.	1	6	6†	7/8 — 1 1/8	..	7 7 8
Do. 4½ % Deb.	100	4½	4½	66 1/16 — 71 1/16 xd	..	6 5 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2 1/16 — 2 3/16	..	4 15 3
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	73 — 80	..	6 5 0
London Elec. Railw'ys, 4 % Deb.	100	4	4	94 — 96	..	4 3 4
London United Trams, 5 % Pref.	10	Nil	..	4 1/16 — 5	..	..
Do. 4 % Deb.	100	4	4	61 — 65	—4	6 3 1
Metropolitan Railway Consol.	* 100	1 7/8	1 7/8	51 1/16 — 52	—1 1/16	3 2 6
Do. Surplus Lands	100	2 7/8	2 3/16	60 — 62	—1	4 8 9
Do. 3½ % Deb.	100	3½	3½	85 — 87	+1	4 0 6
Do. 3½ % Pref.	100	3½	3½	81 — 83	—1	4 4 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82	—1	4 5 4
Metropolitan District Ord.	100	Nil	Nil	38 1/16 — 39	—1 1/16	Nil
Do. 6 % Deb.	100	6	6	135 —138	..	4 7 7
Do. 4 % Deb.	100	4	4	93 — 95	..	4 2 6
Do. 4 % Prior Lien	100	4	4	98 —100	..	3 19 8
Do. 4½ % First Pref.	100	4½	4½	85 — 87	..	5 1 2
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metropolitan Elec. Trams, Ord.	1	6	5†	3/16 — 1 1/16	..	5 18 6
Do. 5 % Pref.	1	5	5	1/16 — 1/8	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	87 — 91	..	4 18 11
Do. 5 % Deb.	100	5	5	91½ — 94½ xd	..	5 5 10
Potteries, Ord.	1	3/4	..	1/16 — 3/16	..	..
Do. 5 % Pref.	1	5	5	1/16 — 3/16	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	84 — 87	—1	5 3 3
South Metro. Trams, 6 % Pref.	1	6	..	1/16 — 1/8	..	7 7 8
Do. 4 % Deb.	100	4	4	65 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	4 1/16 — 4 3/16	— 1/8	Nil
Do. "A"	1/-	..	..	1/16 — 1/16	..	Nil
Do. 6% First Cum. Inc. Deb.	100	..	6	109 —111	..	5 9 1
Do. 4½ % Bonds	100	4½	4½	97 — 99	..	4 10 11
Do. 6 % Income	100	1½	6 †	92 — 93	— 1/2	6 9 0
Yorkshire (West Riding), Ord.	5	Nil	..	1/4 — 3/8	..	Nil
Do. 6 % Pref.	5	3	3½	3 — 3 3/16	+ 1/8	4 5 9
Do. 4½ % Deb.	100	4½	4½	80 — 84	..	5 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4 13/16 — 5 1/16	..	5 8 7
Do. 2nd Pref.	5	5½	5½	4 9/16 — 4 11/16	..	5 14 3
Do. 4 % Deb.	100	4	4	89 1/16 — 91 1/16	..	4 7 5
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % Deb.	100	5	5	98 —100	..	5 0 0
Auckland Trams, 5 % Deb.	100	5	5	101 —103	..	4 17 1
Bombay Elec. S. & Trams, Pref.	10	6	6	10 3/16 — 11 1/16	— 1/8	5 4 4
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	99 —101	+ 2	4 19 0
Brazilian Traction Light and Power	$100	..	6†	99 —101	—1	..
Brisbane Trams Invt., Ord.	5	8	8†	7 1/16 — 7 3/16	..	5 5 0
Do. 5 % Pref.	5	5	5	4 1/16 — 5 1/16	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	..	133 —138	+2	5 16 0
Do. Pref. Ord.	100	6	6	112 —117	..	5 2 7
Do. 5 % Pref.	100	5	5	103 —106	..	4 14 4
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 4½ % Con. Deb.	100	4½	4½	95 — 97	+ 1/2	4 7 8
Calcutta Trams, Ord.	5	7	5†	5 3/16 — 6 1/16	..	5 12 0
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	97 1/16 — 100 1/16	..	4 9 7
Cape Electric Trams	1	2½	..	1/16 — 1/8	..	..
City Buenos Aires Trams (1904)	5	5	5†	5 5/16 — 5 7/16	— 1/8	4 10 0
Do. 4 % Deb.	100	5	5	95 — 99	..	5 1 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	97 —101	..	4 19 0
Kalgoorlie Elec. Trams	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % A Deb.	100	5	5	88 — 88	..	5 13 8
Do. 6 % B Deb.	100	6	3	25 — 35	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	1/16 — 3/32	..	..
Do. Pref.	1	6	..	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1 — 1 3/32	..	4 7 3
Do. 6 % Pref.	1	6	6	1 — 1 1/16	..	4 16 0
Do. 5 % Deb.	100	5	5	92 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb.	100	5	5	102 —104	..	4 16 2
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 90	..	5 11 1
Manila Elec. R. and Lig., Bonds	$1000	5	5	98 —100	..	5 0 0
Mexico Trams Com.	$100	7	7†	109½ —111½	—1 1/2	6 5 7
Do. Gen. Con. 5 % Bonds	..	5	5	93 — 95	+3	5 5 3
Do. 6 % Bonds	100	6	6	98 —101	+ 1/2	5 18 10
Para Elec. Rlys. & Lt., Ord.	5	10	10	7 — 7 1/16	..	6 13 4
Do. 6 % Pref.	5	6	6	4 1/16 — 5 1/16	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	99 —101	..	4 19 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5½	1 3/16 — 1 1/4	..	3 14 5
Do. 5 % 1st. Deb.	100	5	5	105 —108	..	4 12 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 3/16 — 5 7/16	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	101 —102	..	4 18 0
Do. 5 % Mort. Bonds	100	5	5	94 1/16 — 95 1/16	+1 1/2	5 4 5
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	101 —103	..	4 17 1
Singapore Trams, 5 % Deb.	100	5	5	83 1/16 — 87 1/16 xd	..	5 14 3
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 1/16 — 97 1/16	..	5 2 7
Un. Elec. Trams Monte Video	5	7	6†	5 — 5 1/16	..	6 7 3
Do. 6 % Pref.	5	6	6	4 1/16 — 5 1/16	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	98 —101	..	4 19 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98 1/16 —101 1/16	..	4 8 8

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	1/16 — 3/16	..	8 0 0
Do. 6 % Pref.	1	6	6	3/16 — 3/16	..	7 2 2
Babcock & Wilcox	1	28	14†	8 1/16 — 8 1/16	..	4 6 5
Do. Pref.	1	6	6	1 1/16 — 1 1/8	..	4 0 0
British Aluminium, Ord.	1	Nil	..	1/16 — 1/16	..	..
Do. 6 % Cum. Pref.	1	Nil	..	1/16 — 1/16	..	..
Do. 5 % Prior Lien Debs.	100	5	5	93 — 96	+1	5 4 2
Do. Deb. Stk.	100	5	5	84 — 87 xd	..	5 14 11
B.I. & Helsby Cables	5	10	10	7 3/16 — 8 1/16 xd	..	5 15 11
Do. Pref.	5	6	6	5 3/16 — 6 1/16	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	..	4 11 10
British Westinghouse, Pref.	8	Nil	Nil	1/16 — 3/16	+1/16	Nil
Do. Deb.	100	4	4	59 — 62	+1	6 9 1
Do. 6 % Prior Lien	100	6	6	98 —101 xd	..	5 18 10
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — 1/4	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	73 — 78	..	6 8 2
Do. 4½ % Deb.	100	4½	4½	38 — 48	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	25 — 29	..	16 13 4
Callender's Cable	5	15	10†	11 — 11 3/16	..	6 7 8
Do. Pref.	5	5	5	4 7/16 — 5 1/16	..	4 17 7
Do. Deb.	100	4½	4½	98 —101	+1	4 9 1
Castner-Kellner	1	20	20	8 1/16 — 8 3/16	..	5 5 3
Do. Deb.	100	4½	4½	103 —106	..	4 4 11
Crompton & Co.	3	Nil	..	1/16 — 3/16	..	Nil
Do. Deb.	100	5	5	55 — 57	..	9 15 6
Dick, Kerr	1	5	Nil	3/16 — 5/16	..	..
Do. Pref.	1	6	6	3/4 — 29/32 xd	..	7 18 10
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £8 paid	5	Nil	..	1/16 — 3/16	..	Nil
Do. fully paid	5	Nil	..	1 1/16 — 1 1/8	..	Nil
Do. 4 % Deb.	100	4	4	61 — 65	..	6 3 1
Do. 5 % Second Deb.	100	5	5	70 — 73 xd	..	6 17 0
Electric Construction	2	2½	3⅛	1 1/16 — 1 1/8	..	5 14 4
Do. Pref.	2	7	7	1 15/16 — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	6	92 — 94	..	5 4 2
General Electric, 6 % Pref.	10	5	6	10 — 10 3/16	..	5 11 7
Do. Deb.	100	4	4	88 — 93 xd	..	4 6 0
Henley's, Ord.	5	15	15	12 1/16 — 13 1/16	— 1/8	5 17 2
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4 7 10
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	..	7½	10 — 11	..	6 16 4
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction	12	17½	17½	34 — 36	..	5 16 8
Do. Deb.	100	4	4	96½ — 98½	..	4 1 3
Willans & Robinson	1	Nil	..	1/16 — 1/16	..	Nil
Do. Pref.	5	Nil	..	1/4 — 3/4	..	Nil
Do. Deb.	100	4	4	57 — 59	..	8 15 7

* Unless otherwise stated, all share are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

Bank rate of Discount 5 per cent., October 17th, 1912.

PROCEEDINGS OF INSTITUTIONS.

Recent Developments in the Street Lighting of Manchester.

By S. L. Pearce, M.I.E.E., and H. A. Ratcliff, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Manchester, February 25th, and London, Birmingham and Glasgow.*)

(*Concluded from page* 583.)

Experiments were also made in equipping the lamps with enamelled iron reflectors of various shapes, but it can hardly be said that the results were very successful, at any rate from the point of view of the distribution of the light. Reflectors were really tried in order to remove the shadows under the lamps cast by the ash-trays; but for this purpose they were only partially successful, and the resulting distortion of the polar curve was very unsatisfactory. One objection to the use of reflectors is the dark shadows cast above an angle of about 80° to the vertical, as a result of which the blackness of the buildings and the darkness above the lamps are very much intensified. This is particularly noticeable in foggy weather. There is no doubt that it is a distinct advantage to illuminate as large an area of buildings as possible, provided always that it can be done without a reduction of the light flux in a more useful direction. If the elimination of shadows can therefore be effected by more legitimate means, there is no advantage to be gained by the use of reflectors. It is very evident, from the results, that the most satisfactory curves of light distribution are obtained either with suitably frosted outer globes or with dioptric inner globes used in conjunction with partially opalescent outer globes. There is very little to choose between the two methods on the score of light distribution. The dioptric globes undoubtedly have a slight advantage in this respect, but when it comes to the consideration of general advantages and disadvantages, there is much to be said in favour of the partially-frosted outer globes.

The advantages are :—

(*a*) Comparatively inexpensive to produce.

(*b*) The degree of frosting may be easily varied or graded as required.

(*c*) They have no optical centre, and consequently slight relative displacement of globe and arc is of no serious consequence. (This must not be confused with relative displacement of arc and economiser.)

(*d*) Intrinsic brilliancy of the light source is considerably reduced with a corresponding reduction of the glare effect, provided that the lamps are fixed sufficiently high.

(*e*) Shadows under the lamps are entirely eliminated, and the sharpness of the shadows cast by objects is toned down very considerably.

Compared with these advantages dioptric globes have the following disadvantages :—

(*f*) They are rather expensive.

(*g*) They have a very definite optical centre, and slight alteration in the relative position of arc and globe produces large changes in the light distribution.

(*h*) A completely uniform distribution of light does not appear to be obtainable without the use of special outer globes.

The numerous tests referred to in this paper have at least vindicated the lighting of city streets by means of flame arc lamps, not only on the dual basis of equal cost and illumination, but also on the ground of light distribution.

As there is a substantial difference between the cost of the flame arcs and the high-pressure gas lamps for the same minimum illumination, it would be possible to improve the arc lighting, if considered desirable, by reducing the distances between lamps in the case of future extensions. If fixed at the present height, and 100 ft. apart, the minimum illumination would be not less than 0·75 foot-candle. No attempt has been made to obtain perfectly uniform illumination, since it is very doubtful whether such a scheme would be desirable, even if possible. A variation factor of 3·75 is not excessive, if the change is fairly gradual; and in this respect the partially frosted globes give results quite as favourable as the dioptric ones.

APPENDIX A.—Manchester Corporation Electricity Department.

Statement of Cost of Supplies during the Year ended March 31st, 1912.

	Total.	Division. Running costs.	Fixed costs.
Generation costs, distribution costs, rents, rates, and taxes, management expenses, interest charges, depreciation account, reserve funds, rate aid	£447,498	£87,431	£360,067
Deduct : Cost of traction supplies taken in accordance with the Model Form drawn up by the I.M.E.A. and M.T.A.	109,389	25,078	84,311
	£338,109	£62,353	£275,756

(*a*) Running costs: £62,353 ÷ number of units sold (other than traction), 64,466,224 = 0·232d. per unit.

(*b*) Fixed costs: £275,756, divided on following assumptions :—

(i) That the costs are due to the maximum demands of consumers.

(ii) That these (known only in total of 31,475 kw. from station records) are estimated to be made up thus :—

70 per cent. of lighting connections,

24,031 kw.	= 16,821 kw.	£147,371
The balance as power	14,654 kw.	128,385
	31,475 kw.	£275,756

(*c*) Lighting "fixed costs" spread over total kilowatts connected :—

£147,371 ÷ 24,031 kw. = £6·133 per kw. connected.

APPENDIX B.—Statement Showing Cost of Current per Unit.

Cost of current = £6·133 per kw. connected, plus 0·232d. per unit metered.

(*a*) The all-night lamps run on a 45 per cent. load-factor, or 4,015 actual burning hours per annum. Cost of current per unit = 0·6d.

(*b*) The 11 o'clock lamps run on a 23 per cent. load-factor, or 2,017 actual burning hours per annum. Cost of current per unit = 0·97d.

APPENDIX C.—Statement Showing Cost per Annum of Lighting Portland Street.

Lamp watts = 550.

Carbon costs = 0·2d. per lamp per hour.

Trimming and maintenance charges = 0·05d. per lamp per hour.

Current consumption per annum (all-night lamps = 4,000 × 55/100 = 2,200 units + 11 o'clock lamps = 2,000 × 55/100 = 1,100 units) = 3,300 units.

	Cost per lamp per annum.
All-Night Lamps.	
Current, 2,200 × 0·6d.	£5 10 0
Carbons, 4,000 × 0·2d.	3 6 8
Trimming and maintenance, 4,000 × 0·05d.	0 16 8
	£9 13 4
11 *o'clock Lamps.*	
Current, 1,100 × 0·974d.	£4 9 0
Carbons, 2,000 × 0·2d.	1 13 4
Trimming and maintenance, 2,000 × 0·05d.	0 8 4
	£6 10 8
Summary.	
Cost of 8 "all-night" lamps	£77 6 8
„ 8 "11 o'clock" lamps	52 5 4
	£129 12 0
Capital expenditure on installation, £564.	
Capital charges per annum (8½ per cent. on £564)	48 0 0
Annual acknowledgments for building attachments and use of tramway poles	1 4 0
Annual cost of painting poles	3 6 6
Total	£182 2 6

Averaged over 16 lamps, the cost per lamp per annum equals £11 7s. 8d.

Capital spent on installation of the 16 *arc lamps in Portland Street.*

Wages of men	£88 18 5
Material, viz.—	
Arc lamps, poles, wire, carbons, hangers, &c. ...	342 0 4
Meters	4 17 6
Paid to Tramways Committee for erecting side poles, wall rosettes, and span wires	128 6 7
	£564 2 10

or, say, £564.

APPENDIX D.—Statement Prepared by Mr. Abady, Showing the Cost per Gas Lamp (11 o'clock) per Annum.

Cost of gas, uncompressed	12·69d. per 1,000 cb. ft.
Cost of compression	1·2d. „ „
Cost of gas, compressed	13·89d. „ „
Mantles	1s. 1½d. each.

Wages—Proportionate part of time of one man (whole time at 28s., and one man for six hours a week at 25s.): £1 7s. 2d.

Each lamp consumes 80 cb. ft. of gas per hour for 2,000 hours per annum.

One mantle lasts about 400 hours, therefore each three-burner lamp takes 15 mantles per annum.

Lamps attended to and maintained at a wages cost stated above.

	Cost per lamp per annum.
80 cb. ft. by 2,000 hours = 160,000 cb. ft. at 13·89d. per 1,000	£9 5 2
Lighting, extinguishing, cleaning and maintenance ...	1 7 2
15 mantles at 1s. 1½d. each...	0 16 10½
	£11 9 2½

Equivalent to 1·37d. per hour lighted.

Nothing is included in the above for interest and depreciation on capital spent on installation, or for globes.

Capital spent on Installation of the Four Gas Lamps in Princess Street.

Wages	£12	6	6
Lamps	49	17	6
Poles	33	0	0
Suspension gear and rosettes	26	16	10
Barrel and fittings...	2	1	2
Tramway account for work done ...	70	9	4
	£194	11	4

Nothing is included in the above for high-pressure mains or compressor plant.

Discussion at Birmingham.

Mr. R. A. Chattock said the comparative figures of the cost of electric arc lighting and of high-pressure gas lighting were very valuable, especially as they were obtained by experts appointed by the Manchester Corporation to report on both classes of lighting. They demonstrated that high-pressure gas lighting was considerably more costly than electric arc lighting. The cost of the high-pressure gas lighting amounted to £11 9s. 2½d. per lamp per annum without including anything for interest and depreciation on capital spent on the installation, and without globe renewals, while the cost of the electric arc lighting amounted to £11 7s. 8d. per lamp per annum, including all capital and other charges. In Birmingham practically the whole of the street lighting was carried out by low-pressure incandescent gas mantles, and this was now under the control of a special Lighting Committee. In the Handsworth and Aston areas, which were recently incorporated in Greater Birmingham, there was a small amount of electric arc lighting, which had recently been considerably cheapened in cost. Taking the Handsworth district as an example, there were originally 120 open-type 11-ampere arc lamps which required recarboning every 18 hours. These were replaced by 50 magazine flame-arc lamps taking 8 amperes each, and requiring retrimming every 70 hours, and 70 twin-carbon flame-arc lamps taking 7 amperes each, and requiring retrimming every 50 hours. In the table below are given particulars of the consumption of energy, cost of energy, carbons and trimming, and illumination in candle-feet, the lamps being spaced approximately 400 ft. apart. The 8-ampere magazine flame-arc lamps showed a saving of 25 per cent. in running costs, and gave approximately four times the light given by the old open-type lamps, each lamp costing £5 2s. per annum for energy, at 1d. per unit, carbons and trimming, from dusk to 11.15 per p.m. The 7-ampere twin-carbon flame-arc lamps showed a saving of 30 per cent. in running costs over the 11-ampere open-type lamps, and gave over twice the light, each lamp costing £5 per annum for energy, at 1d. per unit, carbons and trimming, from dusk up to 11.15 p.m. The shadows caused by the ash-trays in the lamps fitted with converging carbons are not found in the case of the twin-carbon lamps fitted with vertical carbons.

Handsworth Street Lighting.

	Consumption in units per annum.	Cost of energy at 1d. per unit.	Cost of carbons.	Cost of labour.	Total cost.	Illumination in candle-feet, measured on road surface. Max.	Min.	Average.
Main Road—								
Original installation—50 open-type arcs, 11-ampere, 18 hours.	44,750	£186 10 0	£17 10 0	£146 0 0	£350 0 0	0·51	0·02	·14
Present installation—50 magazine flame arcs, 8-ampere, 70 hours.	33,000	£137 15 0	£50 0 0	£72 15 0	£260 10 0	2·35	0·05	·66
Side Roads—								
Original installation—70 open-type arcs, 11-ampere, 18 hours.	65,000	£271 10 0	£25 0 0	£204 0 0	£500 10 0	0·51	0·02	·14
Present installation—70 twin-carbon flame arcs, 7-ampere, 50 hours.	40,000	£166 10 0	£79 10 0	£100 10 0	£346 10 0	1·0	0·04	·327

Mr. E. Crocker said the great problem in connection with street lighting appeared to be to make the variation factor as small as possible, and the change from maximum to minimum illumination as gradual as possible, and to do this not regardless of cost. In this connection the design of the globes played a most important part, and the information given in Mr. Pearce's paper was exceedingly valuable. He had experimented on much the same lines, with very similar results. He had not, however, tried frosted globes, and it was with these that the authors had obtained their best results. Their variation factor of 3·75 with frosted globes was an enormous improvement. The variation factor of the gas lighting in Bristol Road was as high as 18 over a distance of only 20 ft. from the lamp post. He agreed with the authors' remarks *re* the use of outside reflectors, and the importance of illuminating the buildings on the sides of the road. Steadiness was a most important thing to be aimed at in street lighting, and this was the most striking feature of high-pressure gas lighting, although, as the author remarked, the candle-power varied considerably from day to day. When testing some of the arc lamps which they had had on trial at Handsworth, he had been able to obtain a balance almost, if not quite, as readily as with gas lamps. Lamps with direct electrically-driven feeds gave the steadiest burning. By this he meant lamps in which the feeding was effected by an auxiliary shunt coil, which came into action when the volts across the arc were above the normal, so regulating the feed that the drop across the arc was not more than 1 volt, and thus maintaining steady burning. With a feed which depended upon the slip of a chain or band brake, or piece of metal on a wheel controlled by a lever operated by a main and shunt coil, one could not depend upon a 1-volt feed. Generally, the variation was 2 or 3 volts or more, and this affected other lamps in series, especially if these were themselves on the point of feeding. His experience with flame-arc lamps was that they required cleaning, and the deposit from the carbons brushing out, after 60 to 70 hours' burning at least; and if the lamp had to be lowered for this purpose, it might just as well be carboned at the same time. Another important point with regard to the choice of magazine lamps for street lighting was that there should be no extinction of light when a new pair of carbons came into operation.

Mr. M. Solomon said that although the data contained in the figures were very valuable, their value was diminished by the fact that some of the figures were not referred to at all in the text, and the shading was different in the two sets of contour figures, so that the actual impression created was a wrong one. The comparative table showed the arc lamps to be, roughly speaking, twice as good as the gas lamps, but it was admitted that the gas-lamp figures were not really representative of the best that could be done with high-pressure gas lighting. He did not think that it was of any benefit to create the impression that arc lighting had a walk-over as against high-pressure gas, when, as a matter of fact, it was a very close race between the two rival illuminants. Improvement in the distribution curves (apart from that due to the graded frosting) was attributed to the alteration of the spinnings and of the shape of the outer globe; the shape of the inner globe was also altered, and a very considerable amount of the improvement in the 20° rays was due to this alteration, as the new inner globe was designed so that the light reflected from its inner surface should be reflected at an angle of 20° with the horizontal. He had been struck by the very close correspondence between the light distribution curve obtained by the authors and his own curve, obtained under laboratory conditions, while theirs was made under practical working conditions in the street; this not only confirmed the accuracy of both sets of readings, but also showed that flame lamps and carbons were now so standardised that the results obtained might be relied on with considerable certainty.

Mr. A. M. Taylor thought the most important thing in the paper was the table which comprised a *résumé* of the principal features of the two systems, gas and electricity. He suggested that the variation factor for the two systems might be added, and an additional basis for comparison, which would be known as the "Maximum variation of the candle-feet per foot run." The gas people could not and should not take any exception to the division of the total costs into "Running Costs" and "Fixed Costs" nor to the deductions on account of the cost of traction supplies. Mr. Pearce, had, however, carried the distribution of costs further, and allocated a certain proportion to lighting and to power respectively. He had worked out what the fixed charge would be if the whole had been simply divided up by the total number of kilowatts; it came to £8·76 per KW. connected, per annum. This added an amount of approximately 25 per cent. to the charge for energy for the "All-night lamps," and approximately 33 per cent. to that for the "11-o'clock lamps." This was obviously an extreme view to make, and it might be taken as certain that Mr. Pearce's figure of £6·133 per kilowatt was substantially correct. The cost per mile per annum (for presumably equal minimum illumination) was given as £675 for the gas and £254 for the arcs. Gas according to this statement was 2·65 times as dear as the electric light for equal illumination, so that it would be obvious that any trifling divergencies from Mr. Pearce's figures for the cost of energy which might be suggested by the gas people, could not to any material degree affect the great superiority of the figures for the electric supply on the basis of cost.

Colliery Cables.

By W. T. Anderson, M.I.E.E., M.Inst.M.E.

(*Abstract of paper read before the* Institution of Mining Engineers, *at Manchester, February 11th*, 1913)

The first question that confronts the mining man who proposes to install electric light or power below ground is the choice of cables. Under normal conditions rubber is undeniably the best both from physical and from electrical points of view. On account of cost, its use is almost prohibitive for large cables. In small lengths, however, rubber cable (generally treated with fire-resisting braids and compounds) is nearly always used for making off, or tailing, cables of other description. Nothing but the very best material should ever be used below ground, say, 2,500-megohm grade for low-tension, and nothing inferior to that specified by the Engineering Standards Committee for high-tension work.

There are also exceptional uses to which rubber cable can be put—principally in connection with breakdown work. An example is given in the accompanying illustration (fig. 1). The cables shown were hurriedly rigged up to follow down a sinking pump in a flooded shaft. Working at a current density of about 3,000 amperes to the square inch, they were slung in the manner depicted to prevent them from becoming unduly hot.

While paper-lead covered cable has advantages as regards withstanding heat from without, and ready dissipation of heat from within, consequent upon overload, paper has the disadvantage common to all fibrous materials of being more or less hygroscopic.

For mining work where temperatures are often high, and more especially for shaft work, the physical consistency of the impregnating compound under working conditions should be such that it has no tendency to flow or creep away from the paper.

Although the results of injury to paper cables are usually serious, it is remarkable how much mechanical stress they will withstand. The writer believes that at Hulton Colliery, not a single cable was

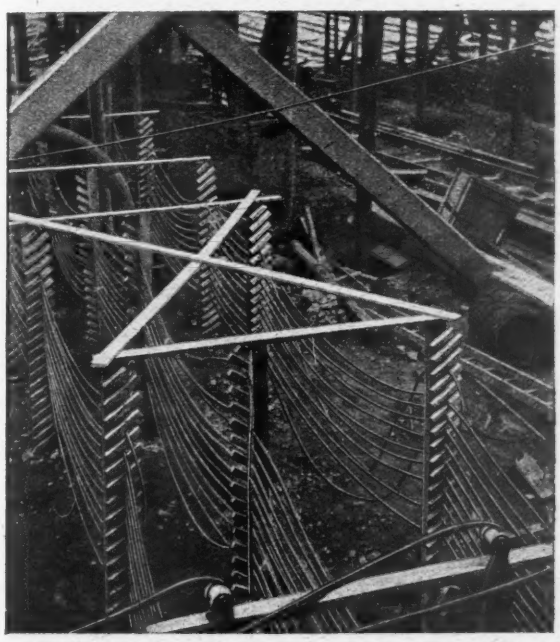


Fig. 1.—Rubber Cable slung ready to follow down a Sinking Pump in a Flooded Shaft.

brought to bank after the recent disaster, and that all are now in use. The cables lay under falls, the weights of which have probably never been exceeded, many being crushed into abnormal shapes.

Paper leadless cables are insulated with paper and sheathed with a non-metallic material, which is almost invariably vulcanised bitumen. They have certain advantages in the way of dissipation of heat due to overload, and also as regards internal solidity, because of the comparative incompressibility of the paper insulation. In the event of damage, however, they have the same disadvantages as paper-lead covered cables, and for shaft work are unsuitable.

Bitumen cables are, in the writer's opinion, by far the most suitable for average colliery work—certainly for shaft work. Until quite recently great difficulty was experienced in getting the bitumen insulation to such a consistency that in moderately high temperatures it would not decentralise, while in low temperatures it would not become brittle. As the result of research and of manufacturing improvements, it is now possible to avoid these troubles over a range of temperature which covers all ordinary working conditions, say, 28° to 120° F. Further, whereas it was necessary formerly to introduce in the construction of the cable mechanical reinforcements, such as tapes, braids, &c., the improvements in physical properties of the bitumen and methods of manufacture now enable cables to be made without these hygroscopic, and therefore electrically undesirable components. For instance, the "solid" three-core bitumen cable, which is familiar to most colliery engineers, is so constructed as to contain no hygroscopic material whatever inside its sheath, so that in effect the conductors are embedded in a solid cylinder of vulcanised bitumen.

A more recent form of construction, called "Cracore" (fig. 2) consists in the laying up of the separately insulated cores on a central cradle of vulcanised bitumen, shaped to receive them. The whole is then sheathed overall with a tube of vulcanised

Fig. 2.—'Cracore" form of Construction in a Bitumen Cable.

bitumen, which is cylindrical on the exterior, but shaped internally so as to fit the interstices of the laid-up cores. This construction, by distributing the mechanical pressure between the cores over a large area, enables even twin bitumen cables to be made without the inclusion of hygroscopic substances anywhere within the boundary of the vulcanised-bitumen sheath.

In these types of cable the conductors should always have the strand interstices filled with compound, in order to prevent water entering at a damaged part of the cable from passing to another part, where it might settle and cause trouble. It is, of course, very desirable that the compound should be of such a character that it will not melt, or become displaced under the influence of heating effects set up by excessive currents in the conductors. In cable manufactured on these lines, the important advantage is secured that any mechanical damage which may happen to it is quite local in its effects, and in many cases it may be repaired *in situ*, and be little the worse for its misadventure. An instance recently came under the writer's notice where failure to take this simple precaution of strand-filling resulted in water travelling down a bitumen cable throughout its entire length. Unlike paper, however, it was possible to keep the cable in use, it being little the worse, so far as its dielectric was concerned, for the mishap. Bitumen cables should not be installed immediately after direct exposure to frost or very keen winds.

In all of the above-mentioned types, if used for pressures exceeding "low pressure," it is now necessary that the conductivity of the metallic coverings must be at least equal to 50 per cent. of that of the largest conductor which they enclose, and in no case of less cross-sectional area than that equivalent to 0·022 sq. in. of copper. This last-named point would appear to apply to even the smallest size of trailing cables.

Fig. 3, for which the writer is indebted to Mr. C. J. Beaver, shows the approximate relation between the conductivity of the "largest conductor" and metallic sheaths (made according to the Engineering Standards Committee's tables) in several types of cable. From this it will be seen how very slightly it has been necessary for manufacturers to reinforce the sheathings of any but large-sized cables under the new rules. As in most great reforms, however, the new rules are likely to lead to some remarkable situations—none more so than in this very question of armour conductivity.

Taking a high-tension system, with transformers at the shaft-bottom, the high-tension shaft feeder taking, say, a tenth of the current of the low-tension roadway cable or cables, what must the section of the high-tension armouring be? Logically five times the conductivity of the high-tension conductors, if there be only one low-tension distributor, or half the conductivity of the largest low-tension cable if there be more than one distributor. It appears that the spirit of the rules could only be met in this case by running separate and additional conductors at earth potential down the shaft, in parallel with the sheathing of the high-tension feeder.

The importance of efficiently protecting the armouring from corrosion can hardly be exaggerated. Both inner and outer servings of jute, as well as the steel-wire armour, should be heavily and separately compounded with water-resisting mediums. Where particularly bad water is suspected, or known to exist, samples should be submitted to the manufacturer, so that he may design his protective arrangements in accordance with the result of analysis.

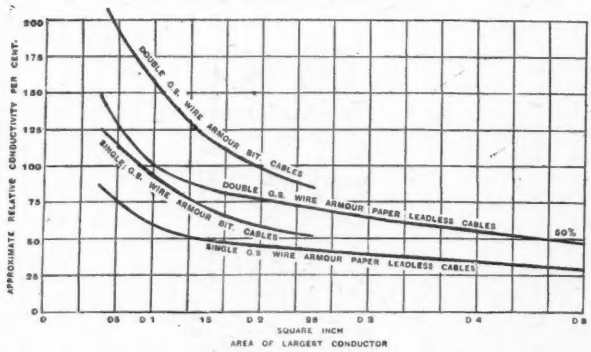


Fig. 3.—Diagram showing the Relationship between the Conductivity of Standard Wire Armour and that of the Cable Conductors in Bitumen Three-Core Low-Tension Cables.

A factor which is often overlooked as a cause of corrosion is leakage current; mines are nearly always wet enough and the water impure enough to provide a sufficiently good electrolyte for leakage currents to effect an almost unlimited amount of damage. This being so, the obvious course is to provide their paths (generally the cable sheathings) with such sound mechanical and electrical connections to earth that corrosion cannot take place.

The chief essentials in the construction of trailing cables are those relating to flexibility and resistance to external abrasion and ill-usage. The former is attained chiefly by making the conductors of a large number of fine wires, and the latter by special coverings, usually of a non-metallic character, such as rope-lappings, leather or whipcord braidings, rubber sheathings left bare, &c. Metallic armourings are now considered undesirable for portable flexible cables (see memorandum on Rule 13, Sec. *a*).

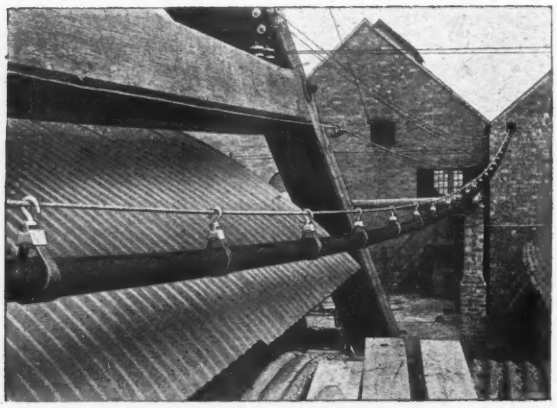


Fig. 4.—Cable supported by Slings from a Catenary Wire.

The latest construction consists of rubber-insulated conductors laid up with an earth-conductor having a conductivity of not less than 50 per cent. of that of the largest main conductor, with a minimum conductivity equivalent to 0·022 sq. in. of copper. These cores are usually sheathed after laying up with a vulcanised-bitumen or rubber sheath. While it possesses the obvious advantage of excluding moisture from the cores, the mechanical support afforded by the sheath also tends to prevent kinking of the cable. The various forms of mechanical protection mentioned above are then applied as desired.

The space between the generating station and the headgear is, perhaps, the most prolific field of any for cable breakdowns, and too much attention cannot be given to the handling of cable in this area.

A large colliery was completely stopped through two three-phase bitumen shaft-cables breaking down simultaneously at bank, owing to a 1-in. steam pipe being laid across them.

The best means of grappling with this difficulty are either to build a well-ventilated surface culvert (open or covered with chequer-plate), in which the cables can be carried on brackets, or to sling them overhead from a catenary wire (fig. 4). Old haulage-ropes can generally be used for this purpose, made taut with capels and tightening screws. A good type of sling much used by the writer for this purpose is made on the wedge principle, with a former of sheet lead, braided with compounded yarn. The combination of lead and braid offers prolonged resistance to fumes or atmospheric influence, while the exceptional width provided at the

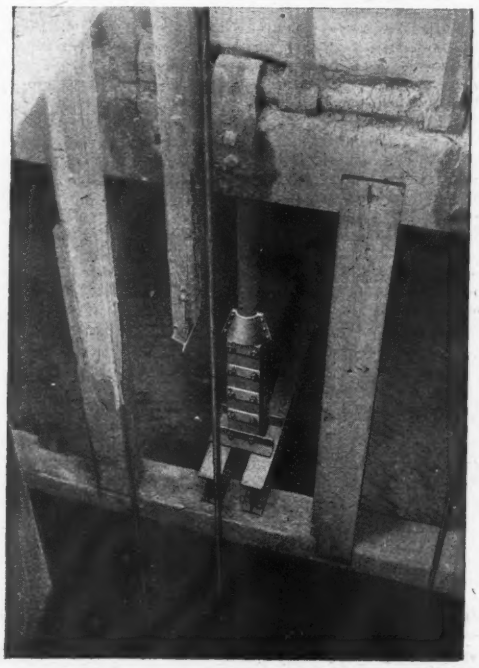


Fig. 5.—Sitting Type of Wooden Cleat for Shaft Suspension, resting on existing Buntons.

bearing point protects the dielectric from risk of damage. The hooks slide very readily along the span wire, while the slings cannot slip along the cable.

If the shaft is some distance from the power house, the use of paper lead-covered cable laid solid is worth considering. In such a case, a disconnecting box should be inserted at the pit top. For greater distances, especially on extra-high-tension lines, bare overhead conductors are frequently used.

For the permanent installation of vertical cables, the most desirable arrangement is a cleat of the sitting type resting on the inner or wall sides either of existing buntons (fig. 5), or on segmental H-girders erected for the purpose (fig. 6). The cleat should be of

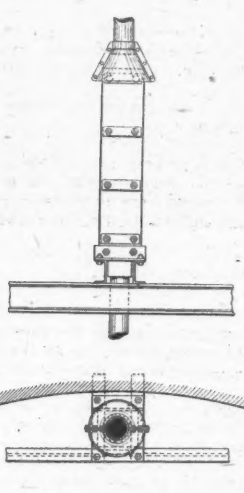


Fig. 6.—Sitting Type of Wooden Cleat for Shaft Suspension, resting on H-Girders.

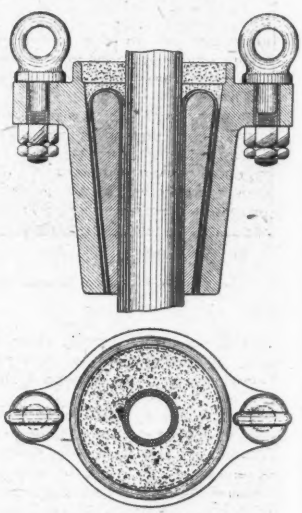


Fig. 7.—Fitting for "Single-Suspension" Method in Shafts.

some hard wood, creosoted. An average cleat should not be less than 2½ to 3 ft. in length, and should be provided with at least three sets of ¾-in. bolts and iron straps ⅜ in. thick, back and front. The bores that take the cable should be cut to the exact diameter of such cable. The ⅛ or $\frac{3}{16}$ in. taken out by the saw when cutting them into halves will allow ample margin for tightening. The grip depends on friction, and direct pressure is only a component thereof. All wooden cleats should be fitted with wrought-iron roofs, so as to throw off water and falling bodies. The distance between the cleats will depend on the weight of the cable. Such a one as

mentioned above should not be loaded with more than 7 to 8 cwt., which, in an average cable, would allow of spacings of about 25 yards.

Many colliery engineers insist on having an absolutely clear shaft, and in shallow pits it is possible to install the cables with a single suspender, built on the capel or wedge principle, with the outermost armour of the cable taking the weight. This certainly has the advantage of offering no obstacle to break the fall of dropping material, but the use of such a fitting (except perhaps for short lengths of paper-lead covered cable) is to be deprecated, as the stresses set up in the cable have sometimes led to breakdown immediately under the suspender, where, of course, the stresses are most concentrated.

In the suspender illustrated in fig. 7, it will be noticed that the cable forms an easy fit through the bore of the cone, over the outer sides of which one layer of armour is bent, and gripped between the cone and the seating as the weight comes on. The top of the fitting is hollowed so as to allow of bitumen being poured in to prevent corrosion of the wires. In this suspender three-quarters of the breaking stress of the armour may be reckoned on, so that if the armour be designed with a breaking stress of eight to ten times the weight of the cable, the safety factor of the installed cable is from 6 to 7·5.

(*To be concluded.*)

THE FIRST INTERNATIONAL CINEMATOGRAPH EXHIBITION.

(*Continued from page* 554.)

Motor-generators, Converters, &c.—These machines are of the utmost importance in reducing the energy bill in cinema installations taking current from public supply networks. If supply is available at 100-110 volts, it is hardly worth while installing motor-generators or converters, but generally current has to be taken at 200-250 volts, and where very large projectors are used, at 400-450 volts (from power mains), so that there is no longer any question as to the advisibility of employing pressure reducing machinery in place of the equivalent ballast resistance. Where A.C. supply is available, the use of running machinery for pressure reduction may be avoided by employing transformers (of which, and their use, we noticed no example at Olympia*), or by employing mercury rectifiers. The latter enable the high efficiency of D.C. arcs to be realised simultaneously with the simplicity of static pressure reduction, but the high cost and fragility of glass rectifier bulbs are undeniable disadvantages in cinematograph work.

The various types of motor-generators and converters used by the miniature theatres during the recent Exhibition have already been noted: all these machines ran perfectly during the seven days they were in service, despite the fact that they were set to work after exposure to wet weather, without preliminary drying or testing. Broadly speaking, the advantage of motor-generators lies in the flexibility of their control and the steadiness of their output. Auto-converters are lighter, cheaper and more efficient machines, but they are less flexible while being liable to produce a "sensitive" arc unless considerable ballast resistance is used in the projector circuit (see previous remarks *re* advantage of high voltage supply in the arc circuit).

Electric Motor Applications.—Electric motors, of from $\frac{1}{8}$ to $\frac{1}{4}$ H.P. output, find many applications in the operations connected with the manufacture and exhibition of cinema films. For instance, in slow speed cinematography—which now plays so important a part in recording the germination and growth of plants, &c.—an electric motor is used to drive, through variable-ratio reducing gearing, the film and shutter of a cinema camera. The Debrie apparatus, arranged on this principle and shown at Olympia, enables from one picture per second to one picture per hour to be taken and provides 120 intermediate speeds.

The Pathé film perforater (punching 500 pairs of holes per minute), and the Pathé printing machine (printing from 200 to 250 ft. of positive film per minute) are each driven by $\frac{1}{6}$ H.P. motors. An all-important part is played by a special form of electric motor in the stencil-cutting machine used by Pathé Frères in the manufacture of their colour films and, since neither this machine nor the Pathé colour process are at all generally known, both may be described in some detail.

The film to be coloured is placed in a projection chamber below the stencil-cutter's operating table, and on to a ground glass screen let into the latter, an image of a single film picture (enlarged about two-fold), is projected by aid of a Nernst lamp and a simple optical system. A pantograph linkwork enables the outline of any part of this image to be reproduced on a blank stencil film. The operator selects certain areas of the picture which have to be coloured—say, blue—and traces round the boundaries of these areas with one style of the pantograph. The reduction ratio of the copying linkwork being identical with the multiplication ratio of the system used to project the image of the film on the tracing table, it follows that the second style of the pantograph cuts out areas of such size and relative position as to enable the film operated upon to be used as a stencil when applying blue colouring matter to the picture film.

It is in the mechanism used to cut the stencil that the chief interest of the machine lies, from the present standpoint. A pair of vertical electromagnets are used to rotate a horizontal winged plate (pivoted on a vertical spindle), against the control of a spring. Directly the plate has turned through a small angle, it breaks a contact in the magnet field circuit, and therefore returns to its original position; the plate is thus maintained in very rapid oscillation so long as a master contact is closed by depressing the tracing style on to the film image. The oscillation of the winged plate is converted to a vertical reciprocation of a fine stencil-cutting needle by a short connecting rod mounted in spherical seatings in a lug on the winged plate and the outer end of a forked lever engaging with a collar on the needle stem. Normally, the connecting rod is in an oblique position, but, as the winged plate rotates, the connecting rod is raised to a nearly vertical position, and thus thrusts the needle down (through the stencil film into a fibre backing block), against the control of a spiral spring. This action is repeated with extreme rapidity during the whole time the tracing style is moved over the film image and the required stencil is, therefore, demarcated by a series of perforations so closely contiguous that the central portions of each closed area can be easily picked out, leaving the clean cut edges shown in fig. 1, which reproduces an example of the work done by this machine.

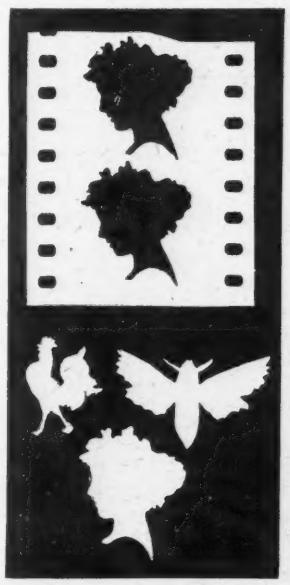


FIG. 1.—PATHE STENCILS FOR COLOURED FILM.

A stencil is cut for every picture in the film, and for every colour to be applied to the latter. Less than three colours are never employed in composing the final coloration, and, in the best films, as many as seven distinct colours are applied, so that from 48 to 112 stencils have to be cut for every foot length of the film dealt with. About 100 colour films can be made from each set of stencils, so that, assuming 1,000 ft. of film to provide 20-minutes' entertainment from 2,400 to 5,600 stencils have to be cut to provide each minute's Pathé-colour entertainment in 100 halls simultaneously.

The actual colouring of Pathé films is a purely mechanical process. The film to be dyed is passed through an electrically-driven machine which applies that aniline colour for which the stencil film was cut, through the latter on to the picture film. As many films as possible are thus treated till the stencils begin to show signs of wear. The dye in the machine is then changed to suit the next stencil, and the films are over printed with the second colour, and so on till all the selected component tints have been applied.

The electric driving of projectors is very desirable, since it ensures uniform speed, and leaves the operator free to attend to other matters while relieving him of a duty which, especially in long-hour continuous-performance halls, is very monotonous. In most of the motor-driven projectors now on the market, the regulating rheostat is mounted near the motor on the projector stand. This arrangement is being condemned by the L.C.C. on the ground that it considerably increases the risk of firing broken films.

In cinema halls themselves, the applications of small electric motors, include the driving of "Kinesounders" and similar machines, sign flashers, fans and vacuum cleaners, concerning which more is said in later paragraphs.

Electric Lamps and Lighting.—Electric lamps are used almost exclusively in cinema halls and projectors, indeed, electrical energy and apparatus is so intimately associated with every branch of modern cinematography that it may be questioned whether the

* A.C. arcs are, of course, much less satisfactory than D.C. arcs for cinema work, but a considerable number are used in this connection. It is claimed that, owing to the higher efficiency of the D.C. arc, an A.C.-D.C. auto-generator set enables better results to be obtained than auto-transformers while effecting anything up to 20 per cent. economy as compared with the latter.

electrical aspects of the Exhibition were made sufficiently prominent.

The Elektrophotograph. Ges., of Frankfort-on-Main, exhibited several types of "Jupiter" lamps for ordinary or cine-studio illumination. Each lamp comprises two horizontal arcs arranged along the axis of a semi-circular diffusing reflector which, for cinematograph work, is provided with a swinging-front diffusing screen.

The Westminster Engineering Co. exhibited a new type of studio lamp embodying their standard 15-ampere enclosed arc with a diffusing parabolic back reflector and an extended top deflector plate.

For printing films and for projecting purposes in their stencil-cutting machine, Pathé Frères use Nernst lamps.

Space limitations prevent detailed description of the many types of projector arcs exhibited. The design and manufacture of these lamps has reached a high degree of perfection, and no radical alterations have been introduced in the leading makes during the past year or two. The chief developments have been the provision of additional adjustments and increased mechanical strength to ensure rigidity and to suit the heavy currents now employed in large halls. The German exhibits included some exceptionally heavy designs, but we consider the British products shown to be neither electrically nor mechanically inferior to the Continental lamps. Standard

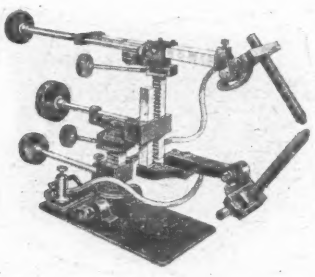


Fig. 2.—Trinity Arc, Set at usual Angle for A.C.

first-class projector arcs, as now supplied for cinema work, have usually seven adjustments, viz., carbon feed, top-carbon traverse (back and front or right and left), and tilting, raising and traversing (to and fro or right and left) of the whole lamp. Among the mechanical improvements adopted to prevent back-lash (initial or due to wear) and consequent unsteadiness of adjustment, may be noted square guides for the main carbon feed bars, parallel guides for the adjustable carbon holder, specially wide rack threads and guide pins preventing side play round racks. There is also a notable improvement in the insulation of terminals and leads on all projector arcs.

The "Trinity" projector arc, exhibited by the Cinema-Halles Trading Co., is worth special notice not only on account of its substantial mechanical construction but also by reason of the swinging jaws provided. The lamp has seven adjustments, and the swinging jaws enable the carbons to be set to give best results with either D.C. or A.C. supply (fig. 2). If desired, the carbons can be set at right angles, and in any case the jaws can be brought within 1-in. of each other, thus reducing carbon wastage to a minimum. This lamp is built in various sizes from 10 to 120 amperes.

The Kamm-"Universal" projector arc has no fewer than nine distinct adjustments, and "remote control" clamping devices are

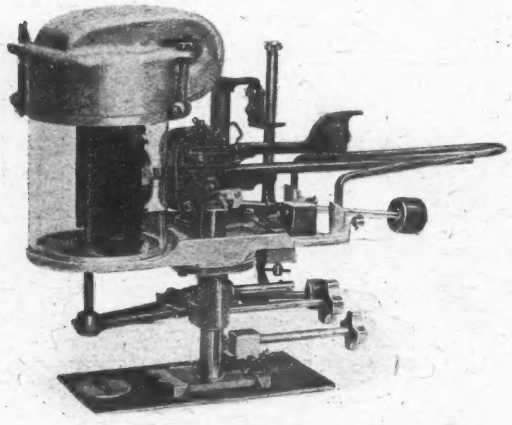


Fig. 3.—Westminster Miniature Enclosed Arc.

provided, so that there is no difficulty in re-carboning while the lamp is hot; the expansion of the clamps merely grips the carbons more tightly.

The Westminster Engineering Co.'s miniature enclosed arcs, using carbons at right angles for projection purposes, have been previously noted in these columns; a 35-ampere model, embodying several new features, has just been placed on the market, and is illustrated in fig. 3. Both carbons are simultaneously fed by a single hand-wheel, feeding being necessary about once in 10 mins. on 200-volt supply. The P.D. required across the arc is 55-65 volts and a maximum of 8,000 C.P. is available in the direction of projection. The lamp is built to enfer any standard projector lantern, and the deposition of soot on the front of the enclosing cylinder is prevented by the provision of a top condensing chamber into which gases pass, on rising from the arc, returning behind a vertical dividing plate in the glass cylinder and through passages in the base-plate. As in the smaller sizes of this lamp, the partial enclosure of the arc secures quiet, steady burning and reduced carbon consumption.

For home or school use the "Pathéscope"—employing a hand or pedal-driven magneto-generator—has gained rapid popularity, but if it is preferred to take current from ordinary supply mains, a miniature arc lamp, or a metal-filament lamp, may be used. The 1·5-2·0-ampere "Jupiter" lamp, burning 5-mm. carbons, enables 5 ft. × 6 ft. pictures to be shown, while the "Ideal" projector, shown by the same firm and using a 16-volt metal lamp, makes possible satisfactory projection up to 3 ft. × 4 ft. on the screen.

A number of firms now specialise in the supply of high-grade carbons of suitable quality and size for cinema work, and many of their products were exhibited at Olympia. The E.E. & E. Co. exhibited positive carbons, the tips of which were ground at an angle; this slight departure from usual practice enables a steady arc of the desired form to be obtained immediately on starting up.

(To be concluded.)

Electricity at the Laundry Exhibition.—Although electricity did not play a very important part in the display of machinery connected with laundries at the International Laundry Exhibition, which was held at the Agricultural Hall, London, last week, there were several items of considerable interest on view. Perhaps one reason why electricity is not more fully utilised as a medium for power transmission and heating is that a plentiful supply of steam is a first essential in large laundries, which necessitates the installation of a steam-raising plant, the consequence being that the majority of laundry owners find it at present more economical to put in a steam engine for shaft-driving purposes. At the same time there were indications that electricity is beginning to play a more important *rôle* in laundry work, for, as one walked around the Exhibition, one came across a number of machines that were driven by directly coupled electric motors. Thus, Messrs. James Armstrong & Co., of Queen Victoria Street, E.C., displayed, in addition to an electric bleach-making machine, a huge "Trojan" flatwork ironer, with 120 in. × 48 in. cylinder, which was shown in operation driven by an attached electric motor. Messrs. T. Bradford & Co., of the Crescent Ironworks, Salford, Manchester, exhibited an electrically-driven rotary washing machine of 20-shirt capacity, in which the usual steam for boiling purposes was replaced by a gas heater. Messrs. T. Broadbent & Sons, Ltd., Huddersfield, displayed a couple of electrically-driven hydro-extractors, one of which—a 26-in. machine—was belt-driven off the motor mounted on the same bed-plate. The second machine, which was of 48-in. diameter, was of the suspended type, in which the armature or rotor of the electric motor is mounted on a sleeve which is independent of, and can revolve round, the centre spindle of the machine. To the upper part of the sleeve are attached friction shoes, which are thrown out by centrifugal force when the armature commences to rotate, and engage with the inner rim of a clutch secured to the centre of the spindle. The weight of the shoes is regulated so that, when the motor attains its normal speed, the friction developed is equal to the torque of the motor, and slipping ceases. By this arrangement the armature is able to develop practically full power and speed immediately the current is switched on, the rotating cage of the machine being quickly brought up to full speed by the action of the clutch. Messrs. R. G. Whitaker, Ltd., of 22, Southwark Bridge Road, S.E., had on view a new 26-in. hydro-extractor with direct-attached 3-H.P. Crompton motor and an electrically-driven goffering machine. A range of electrically-heated hand-irons was exhibited by Messrs. Isaacs Braithwaite & Son, of Kendal, and one was shown in operation at the stand of the Polysulphin Co., Ltd., of Bristol.

Sterilisation with the Mercury Vapour Lamp.—The use of the mercury-vapour lamp to sterilise water is well known. A further use has been made of it by Herr Otto Haase to sterilise underclothing. The process favours the polymerisation of the oxygen with the formation of ozone, resulting in rendering the garments thoroughly aseptic and destroying all pathogenic germs, without affecting the texture or suppleness of the stuffs. Experiments showed that 13 of the most virulent bacilli succumbed at various periods from 5 to 60 seconds.—*Revue Pratique de l'Electricité.*

Electrical Trades Union.—At the North-Western branch of this Union, Princess of Wales Hotel, corner of Belsize Road and Abbey Road, N.W., on Tuesday, April 15th, at 9 p.m., Mr. Harry Springfield will deliver an address entitled "An Evening with Olive Schreiner."

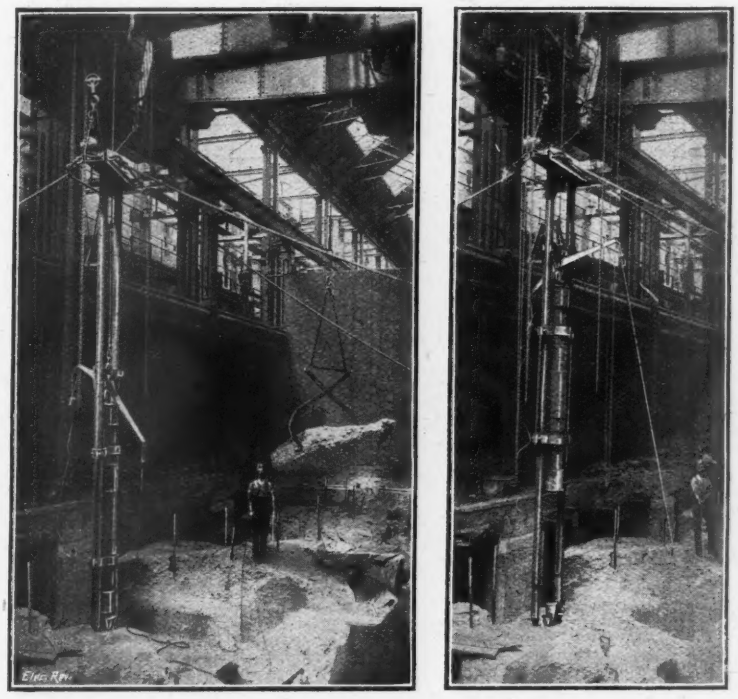
RECONSTRUCTION AT BANKSIDE.

We recently paid a visit to the works of the City of London Electric Lighting Co., at Bankside, where the process of removing the old generating plant and the concrete foundations is in full swing, to make room for the new plant which is on order. Three turbo-alternators of 2,500 kw. each have been running for a considerable time, and a new set consisting of a turbine driving two 1,250-kw. direct-current generators in tandem—the largest d.c. set so far constructed—is in position; another d.c. set of the same size, and a 4,000-kw. d.c. set, in which gear-driving will be adopted, are to be laid down in time for the winter load, and as the existing foundations (which carried Willans-B.T.H. a.c. sets) are altogether unsuitable for the new plant, it has been found necessary to clear them out entirely. As the foundations are of solid concrete of excellent quality, which has set very hard, the work of removal is an undertaking of considerable difficulty, more especially as the proximity of boilers and generating plant in operation precludes the use of explosives.

Under these circumstances, it has been necessary to have recourse to more scientific and effectual methods than that of manual labour, in order to break up the huge masses of artificial stone, which appear to have been designed on the lines of bomb-proof fortifications, and bear eloquent testimony to the thoroughness with which the engineers of 20 years ago carried out their duties.

Having regard to the smooth running of the Willans engine, it would seem that lighter foundations would have sufficed to ensure their stability and freedom from oscillation. Perhaps the intention was to prevent the transmission of vibration to neighbouring buildings, for in those days the phenomena of vibration in connection with reciprocating engines were not fully understood, and even now they sometimes give rise to puzzling effects.

The method devised by Mr. Frank Bailey, joint managing director and engineer to the company, to cope with the difficulty is interesting, more especially as the construction of the apparatus was carried out entirely in the company's well-equipped workshops.



Concrete-Breaker at Work at Bankside.

An old armature shaft, weighing several tons, is employed as a battering ram, being provided with a lifting eye screwed into one end, and with rings sliding on a pair of iron guides. One of the two travelling cranes with which the long bay is served has been furnished with a trigger hook, by means of which the ram can be lifted a few feet; on pulling a rope attached to the end of the trigger the ram is released and strikes a powerful blow after the fashion of a pile-driver. A hole about a foot deep and a few inches square is drilled in the top of the concrete block by hand, taking a couple of men about two hours to do it; heavy wedges are then knocked into the hole, and the ram is allowed to fall upon them, striking a blow of about 100 inch-tons. A few taps of this kind suffice to crack the concrete in all directions, enabling workmen with crowbars to break it up without difficulty. The tup is then used to pound the blocks into smaller lumps, which are carried on a temporary railway to a stone-crusher and reduced to a size suitable for use in making new concrete.

As the device employed is interesting, and may be of use to other engineers in these days when the work of demolition and reconstruction is going on in so many places, we reproduce photographs of the battering-ram, for which we are indebted to Mr. Bailey.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"W. S. D." writes:—"A supply of electricity has been given to a consumer having premises on a lease. The lease having expired, the premises are now vacant. Are the undertakers, upon demand by the owner, bound to take out the service from the building back to the footpath? The owner complained that the cut-outs would be in the way, so the cables were sealed and buried under the floor. He now insists on their coming out altogether."

*** This query raises a point of some interest which it is difficult to answer with certainty, having regard to the somewhat meagre statement of facts. Thus it is not quite clear what is meant by "the service from the building back to the footpath." Is this within the curtilage served by the supply, or is it outside? The obligation cast upon the local authority or company supplying electricity is to give, and continue to give, a supply to owners and occupiers of premises within the area of supply situate within 50 yards from any distributing main in which they are required to maintain, or are maintaining, a supply of electricity for the purpose of general supply to private consumers. The consumer must, if required, bear the cost of so much of any electric main for the supply to him as is laid on his premises, and of so much of such electric main as it may be necessary to lay for a greater distance than 60 ft. from any distributing main of the undertakers, although not on his premises. If it should turn out on inquiry that in the case under notice the owner in question, or his lessee, paid for the service, it would seem that the cables ceased to be, or never were, the property of the undertakers, who cannot now be compelled to remove them.

The Imperial Motor Transport Conference.—The Rt. Hon. Lewis Harcourt, Secretary of State for the Colonies, has consented to become Vice-President of the Imperial Motor Transport Conference, sharing this position with the High Commissioners for the self-governing Dominions. Recent additions to the executive committee of the Conference include Col. the Hon. Sir N. J. Moore, K.C.M.G., Agent-General for Western Australia, the Hon. J. H. Turner, Agent-General for British Columbia, and John Howard, Esq., Agent-General for Nova Scotia. The Army Council has nominated, to serve on the Executive Committee, General F. W. B. Landon, C.B., Director of Transport at the War Office, and the chairman and secretary of the Mechanical Transport Technical Committee. It has now been definitely decided that the exhibition of Industrial Motor Vehicles at Olympia shall open on Friday, July 18th, and the visit of the Conference delegates to the Exhibition is timed for the morning of Saturday, July 19th.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

7,042. "Means for the automatic regulation of the spark from the magneto in electrically igniting and the charge of internal-combustion engines." G. Gray, Jun. March 25th.

7,059. "Electric incandescence lamps." H. Zschocke. March 25th.

7,085. "Electric switches." A. P. Lundberg, G. C. Lundberg, P. A. Lundberg and G. Pegg. March 25th.

7,108. "Arc light electrodes." G. Siemens & Co. (Convention date, March 28th, 1912, United States.) March 25th. (Complete.)

7,125. "Test circuit arrangements for telephone systems." Siemens Bros. and Co., Ltd., and W. H. Grinsted. March 25th. (Complete.)

7,127. "Circuit arrangements for telephone exchanges with automatic selecting devices." Siemens Bros. & Co., Ltd., and T. Pettigren. March 25th. (Complete.)

7,128. "Circuit arrangement for telephone exchanges provided selecting devices." Siemens Bros. & Co., Ltd., and T. Pettigren. March 25th. (Complete.)

7,130. "Devices for showing when junction lines to selecting devices in telephone installations are engaged." Siemens & Halske Akt-Ges. (Convention date, March 23rd, 1912, Germany.) March 25th. (Complete.)

7,146. "Combined dynamos and governors." A. Churchward. March 25th. (Complete.)

7,151. "Control of alternating-electric currents." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 25th. (Complete.)

7,156. "Voltage regulators." W. J. Mellersh-Jackson. (M. Eyquem, France.) March 25th. (Complete.)

7,192. "Electrical accumulators." J. A. Walshaw. March 26th.

7,221. "Automatic telephone." G. Ahlemeyer. (Convention date, December 27th, 1912, Germany.) March 26th. (Complete.)

7,226. "Electrical alarm locks." A. Lewis. March 26th.

7,232. "Ignition and starting systems for internal-combustion engines." L. Langner. March 26th.

7,243. "Electric-plug contacts." A. Schuchardt. March 26th. (Complete.)

7,244. "Supports for electric lamps." H. Wade. (Schneider & Naujoks Elektrizitäts G.m.b.H., Germany.) March 26th.

7,245. "Lighting apparatus." H. Wade. (Schneider & Naujoks Elektrizitäts G.m.b.H., Germany.) March 26th.

7,246. "Lighting apparatus." H. Wade. (Schneider & Naujoks Elektrizitäts G.m.b.H., Germany.) March 26th.

7,252. "Charging accumulators from a variable-speed dynamo-electric machine." J. G. P. Thomas. March 26th.

7,257. "Electric clocks." F. Brunko. (Convention date, April 1st, 1912, Germany.) March 27th. (Complete.)

7,286. "Electric lighting of vehicles." W. G. Lee and P. J. Oldfield. March 27th.

7,288. "Automatic fire alarm systems." E. Garretson. March 27th. (Complete.)

7,298. "Battery compounds." J. W. Mackenzie. (Cook Railway Signal Co., United States.) March 27th. (Complete.)

7,302. "Ignition methods for internal combustion engines." H. Royer. (Convention date, March 30th, 1912, France.) March 27th. (Complete.)

7,305. "Overhead conductors for electric traction systems." K. D. Bowen and Cedes Electric Traction, Ltd. March 27th.

7,311. "Manufacture of electric cables." W. S. Smith and H. J. Garnett. March 27th.

7,338. "Electro-deposition of metals." N. H. M. Dekker. (Divided application on 17,836, 1912, August 1st.) March 27th. (Complete).

7,348. "Telephone receivers and the like apparatus." M. S. Conner. March 28th.

7,360. "Incandescent electric lampholders." C. G. A. Erikson. March 28th.

7,365. "Sparking plugs." H. G. Longford, W. W. Longford and W. A. Clark (trading as Sphinx Manufacturing Co.). March 28th.

7,369. "Switches for electrically operating planing machines and the like." Lancashire Dynamo and Motor Co., Ltd., and W. Hargreaves. March 28th.

7,374. "Lens attachments for electric pocket lamps and the like." H. Neuburger. March 28th.

7,376. "Telephones." A. Sterry. March 28th.

7,382. "Electric insulators." F. Browalski. (Convention date, March 30th, 1912, United States.) March 28th. (Complete.)

7,411. "Flame arc lamps." G. E. Tate and F. O. Monkhouse. March 28th.

7,461. "Attachment for telephone instruments." G. H. Schmal. March 29th.

7,469. "Electric liquid heaters." E. A. Raves. March 29th.

7,502. "Wireless telegraphy." E. S. Heurtley. March 29th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Electrically-actuated Taximeters for Cabs and Like Vehicles. C. Robinson. 27,586. December 8th.

1912.

Means for Transforming Electrical Energy into Heat Energy, particularly Applicable to Hair-drying Apparatus. London Electrical Trading Co. and C. O. Bastian. 5,723. March 7th.

Switch Arrangement for Electric Incandescent Lamps. J. F. Smith. 5,814. March 8th.

Apparatus for the Electrolytic Refining of Iron. G. Tischenko. 5,855. March 8th.

Variable-speed Dynamos for Use in Starting Internal-combustion Engines and the Like. H. Leitner. 6,189. March 12th.

Systems of Electrical Distribution. British Thomson-Houston Co. (General Electric Co.) 6,212. March 12th.

Electrically-controlled Lifts or Elevators. A. Rozier. 6,304. March 13th.

Insulating Supports for the Conductor Rails of Electric Railways. E. T. Brook. 6,473. March 15th.

Device for Supporting Conduits, Pipes or the Like for Electric Conductors and other Uses. J. B. Blake and W. Kilburn. 6,662. March 16th.

Automatic Apparatus for Operating Electric Starting Switches and the Like. W. A. Clatworthy. 6,599. March 16th.

Electric Medical Appliance. E. T. Braarup. 6,645. March 18th.

Electric Indicating Apparatus Specially, though not Exclusively, Applicable for Use on Board Ship. W. D. Kilroy and Evershed and Vignoles, Ltd. 6,792. March 19th.

Electric Lighting Systems for Automobiles. J. Bijur. 6,803. March 19th.

Method of Setting or Adjusting from a Distance through the Medium of Periodic Oscillations of Different Frequency. Erich F. Huth Ges. and H. Behne. 9,181. April 18th. (April 18th, 1911.)

Electric Resistance Furnace. L. Ubbelohde. 9,203. April 18th.

Construction of Electric Bell Push. A. Bonnella. 10,360. May 1st.

Alternating-current Generators. C. R. Shaw, J. G. Shaw and H. G Sharp. 10,427. May 2nd.

Form of Electric Fire-Alarm Apparatus. H. Neal and E. E. Moore. 10,927. May 8th.

Means for Starting Internal-combustion Engines. B. Brooks and W. Holt. 10,996. May 9th.

Machines for Making Electric Incandescent Lamp Bases. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 13,788. June 12th.

Terminal Mounting and Cord-gripping Means for Electric Lampholders, Adaptors or the Like. G. St. J. Day. 14,306. June 19th.

Process and Device for Increasing the Life, Uniformity and Economy of Electric Discharge Tubes having an Incandescent Cathode. R. von Lieben, E. Reisz and S. Strauss. 15,975. July 8th. (July 7th, 1911.)

Apparatus for Uniform Electrolytic Treatment of Metal Strips, Wire and the Like under Continuous Action. F. Werth. 16,535. July 15th.

Devices for Adjusting the Time of Ignition in Internal-combustion Engines Provided with Magneto-electric Ignition Machines. A. G. Bloxam. (Robert Bosch, Firm of). 17,489. July 27th.

High-tension Insulators for Overhead Lines. W. Fellenberg. 17,761. July 31st. (July 31st, 1911.)

Electrodes for Electrolytic Measuring Instruments. H. S. Hatfield and Chamberlain & Hookham, Ltd. 18,341. August 9th.

Electrically-heated Therapeutic Appliances. J. de Bernard and J. Ebbsmith. 19,267. August 22nd.

Rotary Engine with Electrical Power Transmission Gear. A. Beldiman. 19,787. August 29th. (September 23rd, 1911.)

Electric Pocket Lamps. W. Knopf. 22,093. September 28th.

Two-rate Electricity Meters. Landis & Gyr. 24,503. October 26th. (October 27th, 1911.)

Thermo-electric Batteries. H. O. Gross. 25,372. November 6th. (November 6th, 1911.)

Controllers for Electric Motors. L. G. Riley. 25,591. November 7th. (November 8th, 1911.)

Spreaders for Telephone Receiver Casings. P. M. Cox. 26,474. November 18th.

Dry Electric Batteries. J. Bohle and "Volta" Commanditgesellschaft fur Elektrische Kleinbeleuchtung. 26,699. November 20th.

Electrical Heating Apparatus. F. G. Byng and J. H. Collings. 28,542. December 11th. (Divided application on No. 6,763 of 1912, March 19th.)

Book Notices.—*The A B C Guide to Patents for Inventions.* By R. E. Phillips and A. M. Flack. London: Butterworth and Co. Price 2s. 6d. net.—There are few subjects on which so many guide-books are written as that with which this work deals, and necessarily the differences between the treatises are found mainly in the method of treatment. In the book before us, the matter is thrown into paragraphs, arranged under alphabetical headings, with a view to enabling the user to find the point he wants with the minimum of trouble. So far as we have tested it, we have found the arrangement satisfactory.

A First Book of Electricity and Magnetism. By W. Perren Maycock, M.I.E.E. London: Whittaker & Co. Price 2s. 6d. net.—This is the fourth edition of a work which is intended to provide a really easy introduction to the subject; it is written in very simple language, and illustrated with very clear drawings and diagrams, some of which are admirably devised to convey correct ideas, as, for instance, the horseshoe magnet on page 17, in which each of the external lines of force shown is continued throughout the body of the magnet. Starting with the magnet, the author passes on to voltaic cells and electric currents, electromagnetism and electrolysis, and the induction of currents, up to the principles of dynamos and motors; he then commences electrostatics, and eventually shows the connection between this subject and electrokinetics by explaining the action of the condenser. A number of questions is given at the end of each section, and a list of experiments bearing upon the subjects dealt with is appended, together with a priced list of all the apparatus required for carrying out these experiments and many others. The book is exceptionally well printed on good paper.

"Science Abstracts." Vol. 16, part 3, March 31st, 1913. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Proceedings* of the American Society of Civil Engineers." Vol. 39, No. 3, March, 1913. New York: The Society.

"On the Temperature Rise and the Deterioration of the Covering Material of Wire by the Carrying Current." By T. Hirobe. August, 1912. Tokio, Japan: The Electro-Technical Laboratory.

"Atti della Associazione Elettrotecnica Italiana." Vol. 17, No. 6, March 31st, 1913. Milan: Stucchi, Ceretti & Co. Price L 1.50.

"*Bulletin* Mensuel Société Belge d'Electriciens." Vol. 30, January, 1913. Brussels: E. Bruylant. Price 1 fr. 75.

Russian Platinum Tax.—A Reuter dispatch from St. Petersburg states that the Council of the Empire has adopted a resolution of the Duma regulating the conditions of export in the platinum industry. It decided, however, instead of prohibiting the export of raw platinum, as proposed by the Duma, that raw platinum should be liable on exportation abroad or to Finland to a tax of 30 per cent. *ad valorem*.